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From Black to Green:

Midlands to Mid-Wales (& The World) Through a Countryman's Eyes

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1. Life by Four Rivers – Early Days by the Tame, Ystwyth, Severn, & Wye

Introduction

This story is about how I came from the sootiest, most industrial of industrial areas to spend the majority of my life in one of the greenest, most rural and least populated parts of England and Wales. To understand the journey, you must understand where I came from, what has influenced and motivated me, and how, at times, a few rivers have, serendipitously, shaped the chapters of my life.

This is the world as seen through the eyes of a boy growing up in the Blackcountry in the early post-war years, and why, more than half a century later, it is clear that you can take a man out of the Blackcountry but you cannot take the Blackcountry out of a man. That I am a genuine Blackcountryman is confirmed, in my view, by my deep local roots which can be traced back in Wednesbury to Edward Slater in 1626 and probably, with a change of spelling, to John Sclator in 1554.

I remember in Sunday School hearing about the biblical River Jordan and singing “*Roll Jordan Roll*” and “*There’s one more river and that’s the River of Jordan, there’s one more river, one more river to cross*” and imagining, in my childhood mind, a mighty waterway bedecked with real life scenes of the biblical illustrations from our Sunday School literature. In those days of the early 1950s, when I spent almost every weekend by the banks of the River Severn, there was no television in my life and each Sunday I attended Sunday School held in the small, 1860s, red brick simplicity of the Jubilee Methodist Chapel in Pentre, in the

Severn Valley of Shropshire, which provided the words and music for my imagination to work on. Some three decades later I crossed the Jordan from Israel towards the Golan Heights and was filled with disappointment at what struck me to be more a medium sized canal than the mighty river of my imagination. But subsequently, I have got to know a number of real rivers, first hand, warts and all (if rivers can be said to have warts), without the artistic licence which imagination can conjure, and each, to varying extents, has influenced the pathways I have taken at various points in my story.

The ultimate insult to a Blackcountryman is to call him a Brummie, as the unfortunate inhabitants of that alien land called Birmingham are less than affectionately known by their northern neighbours. The Blackcountry essentially pre-dates Birmingham. It is a land once criss-crossed by canals, which then carried the products and lifeblood of industry, and now places such as Tipton, once known as “Tipp’n on the Cut”, and other Blackcountry towns, formerly moated by canals (cuts), are now more frequently crossed and bordered by motorways and feeder roads. Traditionally the Blackcountry was regarded as comprising a number of industrial Staffordshire towns to the northwest of Birmingham including West Bromwich, Dudley, Oldbury, Cradley Heath, Blackheath, Wednesfield, Halesowen, Bilston, Tipton, Darlaston, Wednesbury, and Walsall, the last three of which were where I called home. Today much of this area is subsumed into the Metropolitan District Council areas of Dudley, Sandwell, Walsall and Wolverhampton. But what originally united this area was the so-called “30 foot seam” a band of coal, said to be the thickest in Great Britain, which either outcropped or ran shallowly through this area. This, combined with local iron ore and limestone, provided the essentials for the local metal industries which date back to at least the sixteenth century and by the 1620s it was said that there were 20,000 smiths of all sorts within “10 miles of Dudley Castle”.

By the Civil War in 1642, the area was providing Charles I with cannon, guns, shot, swords and pikes. By the nineteenth century the area had been described as one that "cannot be matched, for vast and varied production, by any other space of equal radius on the surface of the globe" such was the intensity of industrial activity. In 1862 Elihu Burritt was appointed US Consul to Birmingham and wrote about the area, characterising it as "*black by day, red by night*" he was claimed by some for first bringing the term Blackcountry into common usage, although the area had probably been known by this name much earlier. Indeed, a guidebook of 1851 says "*In this Blackcountry, including West Bromwich, Dudley, Darlaston, Bilston and several minor villages, a perpetual twilight reigns during the day, and during the night fires on all sides light up the dark landscape with a fiery glow*". Indeed, even into the 1960s when the blast furnaces were tapped in Bilston Steel Works, some four miles away from my home, the night sky was illuminated with the same "fiery glow" – these furnaces eventually closed in 1979. In the eighteenth and nineteenth centuries in my part of the Blackcountry, Wednesbury was noted for nail making and coal production and Darlaston for nut and bolt manufacturing and gunlock production, the latter the remaining element of the seventeenth century arms industry which later transferred to Birmingham.

I was born in the Blackcountry at my maternal grandparents, Jenny (but Nel to her friends and Ann to me) and George Wadsworths' end of terrace house at 66 Dora Street, Pleck In Walsall, soon returning to the house where I lived until I was about 13, 229 Park Lane, in Fallings Heath, Wednesbury, a couple of miles away by road from Pleck but physically separated by F H Lloyds, then one of the largest steel foundries in Europe, plus a band of "green belt" including old grassland, Pleck Park, allotments, the railway, including James Bridge station and finally the River Tame. What was then F H Lloyds is now IKEA, and gas holders and the M6 motorway now cover much of the previous areas of green.

Our house in Park Lane, which, many years before, was the Seven Stars public house, was populated by myself, my mother Lillian (Lilly), my father Bill, his

brother, my Uncle Maurice, my paternal grandfather John (my grandmother Slater (nee Sarah Jane Phillips) died in 1933) and, I firmly believed in those days, the ghost of a little old lady who sometimes sat in a red armchair in our seldom used front room and moved things on the living room sideboard when the house was empty except for me asleep (or listening) upstairs. My grandfather slept in the attic room and probably did not help the spooky feel of the place when he used to place an empty bottle on a draughty stair to create a ghostly whistle!

In about 1955, cancer caused my dad to have his right leg completely amputated so we eventually we moved round the corner, from our house with a single cold tap and an outside toilet, into 48 Wood Street, where several members of the Slater family had lived and where we could install the bathroom my dad needed (but still no inside loo!) and look after my ageing great aunt Lizzy. We left the ghostly little old lady in 229 and I felt the new house far less threatening. If you imagine a capital L then 229 Park Lane would be at the end of the short limb backed by a garden which linked to the family business which ran along the long limb of the L and ended at 48 Wood Street. On one side of Park Lane's garden was the Park Lane Working Men's' Club and on the other Les Harvey's "garage" or more precisely a scrapyard of the wrecked cars which he bought and sold and recovered from road accidents.

The family business, run by my father, until he died in 1959, was known as Reuben Slater Heath Works and specialised in making sockets for connecting steam and gas pipes. At that time the standard way of making non-cast iron tubes was by bending flat metal and making the connecting sockets was no different, hammering red hot flat metal into welded rings. At the height of the trade the firm had some twenty blacksmith's hearths fired by small cherry sized pieces of coke called breeze, which was collected from the factory's fuel heap using a wide curved fork with many closely spaced tines called a scuvin. Each worker had a hearth, an anvil, a mechanical hammer, (mainly a type called an

Oliver) and a range of hand and sledge hammers for beating the strips of metal in to shape, believe you me it took a “real man” to handle the 14lb sledge for any period of time – I can vouch for that from experience! These men were strong, no gym membership in those days, I remember one whose biceps were such that as a “party piece” he could smash a beer bottle in the crook of his arm by clenching his biceps.

Each socket was made by heating a strip of iron of appropriate width in the hearth until it was white hot then cutting it to length on the Oliver, wrapping it around a former of correct diameter, reheating and hammering the two ends so that they welded together to make a short tube, after which it was rapidly cooled in a metal tank called a bosh and then it was ready for machining to add an internal screw thread and then, job done. From the company accounts for 1901 a socket maker, William Tranter was paid one pound seven shillings and sixpence for a week’s work making 2,750 such sockets, great effort for little return. When tube making technology improved and sockets could be cut more economically from extruded tube, the socket industry declined and the company finally closed in the 1970s due to family circumstances and a long term lack of investment in the business due largely to too many sleeping partners, family members paid by the company for effectively no input, and some with an expensive affinity for alcohol.

Prior to establishing the socket-making business in Wood Street, Reuben (my great grandfather) and his sons were nut and bolt makers in various locations in the Darlaston area and in the 1851 census Reuben’s father Samuel (my great, great grandfather) was a gunlock filer in Catherine’s Cross in Darlaston just a hundred or so yards from where I finished my schooling at the then Darlaston Grammar School and the site of Darlaston Comprehensive School where I taught after graduating.

My mum was a full time mother and home maker and I was her only child. She was educated at Hillary St School in Pleck and had several jobs including working as an usherette at a theatre in Walsall and there accumulated a beautifully illustrated collection of autographs, not only from her friends but also from some of the entertainers of the day. She then went on to be a telephone operator at Walsall telephone exchange, a job she returned to after my father died. She was happiest when she was working with people around her. Full time housekeeping was not the life she would have chosen and she was very unhappy at times at the drudgery and isolation of domestic life. There was a strong mother/child bond between us, but physical affection between any of our family was very rare, not because of a lack of mutual feeling, but because in the hard world of the Blackcountry hugs and kisses, except for grandparents and aunts, were just not part of life, at least for me. In another age I think my Mum would have loved to travel, but in those days she had to make do with pen friends in South Africa, America and Australia and she wrote and received some lovely letters which she shared with me, which I think widened my childhood view of the world and taken with her love of poetry, some of which she taught to me, probably influenced my desire to travel and my love of words. I had many children's books which I read or were read to me, but I particularly remember the ten or so, fat, red covered volumes of Arthur Mee's Children's Encyclopaedia which was thirty years old when I used it, but which I dipped in to with fascination for at least another decade. It was my family's ambitions for me to do the best I could, that led to me becoming the first in my family to go to university. Now that my father was dead, many locals thought I should go straight in to work in one of the local factories and not leave my mother and the Blackcountry, but that was not her wish.

My dad and his brother Maurice were educated at Queen Mary's Grammar School in Walsall, a school where I tried but failed to gain a place. Dad would have liked to have become an architect, but, as eldest son, he ended up in the

less than profitable family business. Maurice, equally clever, did various jobs such as an insurance salesman before he eventually joined H G Smith's Atlas Manufacturing Company in Willenhall, becoming a skilled locksmith and work's manager. He remained there until he retired. He never married but was close to one of the ladies he worked with who lost her husband in the Second World War but she would not remarry. I always think that both of these brothers, who were very intelligent and practical, were never allowed to develop their talents and if born fifty years later would have had many more opportunities in life. Dad was musical and in his younger days played the organ at the Mission Chapel in Darlaston and often took a leading part in local amateur dramatics and musicals.

It is only now, in retrospect, that I fully realise how different was that land in the world of my youth, in the valley of the Tame, to the world I occupy now. Neither of my houses originally had an inside toilet or a bathroom or indeed running hot water and it was a great advance when, in my early school years, my grandparents moved from Dora Street to an old people's bungalow in nearby Gower Street which had a bathroom! No more tin baths by the fire but, for me, a regular weekly visit to Pleck.

At home the open coal fire of the kitchen range provided a constant kettle of hot water and a place at Christmas to spit roast a turkey, or more often a goose, using a clockwork jack which kept the bird turning on a spit and cooked it somewhat kebab-like over many gravy-basting hours. While waiting for dinner I would use the brass toasting fork for its intended purpose and also roast a few seasonal chestnuts on the kettle shelf at the front of the fire. Admittedly most cooking was carried out on our gas stove but usually the Christmas bird was too big for the oven.

Food available in those early post-war years was very different to that available today. We had daily deliveries by horse drawn carts of bread and milk and on my way to my grandmother's house I would often persuade my mother to let me look

in at the nearby Massey's Bakery stables to see their heavy horses. Most bread was not pre-sliced but was crusty and one of my few memories of my grandfather Slater was of him having his regular supper of crusty bread with cheese and a whole raw Spanish onion, remembered because of the tears it brought to my four year old eyes. Baking did have a role in my heritage as George Wadsworth my grandfather, was a baker by profession as was his father and his brothers Charles and Fred after whom my mum's brother Fred (my uncle) was named and you have probably guessed it – I was named after him and my other uncle Maurice. George's brother Fred owned a bakery in Wednesbury where my grandfather worked for many years and Fred had the distinction of being mayor of Wednesbury on two occasions, 1939 -1940 and 1945 -1946, and I just about remember visiting him in the mayor's chamber in Wednesbury Town Hall, when very young, impressed by the chain of office, but not quite understanding the significance of his role. George and Fred were the sixth and eighth of eight siblings. Of the remaining six I only knew Charles (Uncle Charlie) who lived with his wife Hilda at Aldridge, he also was a master baker, made lots of money and retired early and lived surrounded by valuable antiques which the Antiques Roadshow on television would have loved. He was a little man with Poirot-like pointed waxed moustache, and like all his brothers, a thick head of dark hair – clearly my bald pate was inherited from my father's side of the family, as photographs of my father and grandfather show exactly the same head shape and hair loss pattern. The baking gene was not passed on to me, but, on the Wadsworth side, I have two cousins Mary and Margaret, Mary is my "twin" cousin being born some three hours earlier than me to aunt Ivy and uncle Fred, after originally working with at racing stables she has spent much of her subsequent life in the catering trade.

In spite of rationing in my youth I ate far more meat than I do today, chicken was a rarity but beef, lamb and pork were standard. Generally we had a large roasting joint for Sunday lunch, sliced cold on Monday and often minced for a cottage pie on Tuesday. Pork chops with a good layer of fat and cracking appeared most

weeks and my Uncle Maurice had his dinner reheated after work (as our main meal of the day was a cooked lunch – our “dinner” time) and nine times out of ten he would have, by choice, a pork chop. During the post-war years of rationing, potato cakes made from mashed potato and corned beef and shallow fried were firm favourites as was what butchers sold as “mixed grill”, pigs’ liver, lungs (lights) and spleen (melt) to be taken home and fried. On Friday afternoons in Darlaston there were queues of people carrying pots and basins outside Bailey’s Pork Butchers, waiting for hot tubs of chitterlings to arrive. Anatomically these are the cleaned and boiled small intestines of pigs, delicious eaten with really hot English mustard, in some ways the pig version of tripe, again another good meal often on the menu, the tripe being cooked with onions in milk and eaten with mustard, the family’s only brush with “spice”. Cow’s udder, chickens’ feet and pigs’ trotters were always for sale in the 1940s and 1950s, but two of my favourites were sweetbreads (calf thymus gland) and sheep or calf brains, these latter were cleaned, boiled, mixed and chopped with hard boiled egg and served on toast.

At the fishmongers a true Blackcountryman looked forward to the three months from January to March when soft cod roe (chitterling roe) was in season – that the house smelled of fried fish for a couple of days after cooking it was a small price to pay for such a delicacy. Eating out was a bag of fish and chips from the many chip shops in our area, the only downside in the years of rationing, was the use of horse fat for cooking. The food from these shops tasted great but the hot horse fat itself had an unusual, almost sweet smell, as odours drifted from the fryers. I guess by today’s standards our diet was short in fruit and vegetables although we did grow some in the sooty soils of our gardens. We were very conservative in what we ate. Rice was only for puddings, red cabbage was only ever pickled and spicy food was “not for us”. Bread based puddings were a firm favourite and we made sure nothing was wasted but I’m happy to consign marrow jam, made because of a wartime lack of real fruit, to the annals of history. There is one food that I do miss and that is real Blackcountry pork

scratchings. Ironically I can buy items so named in my local butchers and supermarkets but they are impostors. The most common of these is the tooth-splitting hard scratching followed by the increasingly popular, and often flavoured “puffy” scratching. The real McCoy are the softer, less salty, leaf scratchings (technically lard greaves) made from the thin layers of meat left when pork fat is rendered – can be mouth wateringly good.

My great aunt Lizzie was a retired teacher in her eighties when we joined her in our move to 48 Wood Street. My memories of her were of a woman who, like many of her age in those days, could play the living room treadle organ, always wore a woollen shawl and had, to me, who has always loved oven fresh crusty bread, the odd habit of never eating bread until it was three days old in case fresh bread gave her indigestion. She also kept a few chickens until they had long since ceased to lay and were so old that they were lifted on to their perches at night to protect them from the army of rats invading from beneath a nearby factory canteen, which rampaged the area and would rip open the full crop of an accessible chicken. I became quite adept at shooting these rats with an air rifle, which was about as near as I ever got to becoming a gun-toting sportsman.

Opposite our house in Wood Street was what was perhaps best described as a run down small holding, where, in about a one acre plot, were reared chickens and pigs with a small bakery in the out buildings and even more rats. Except out of war time necessity, we did not source much from there as there was never a loaf without at least a few cockroach legs in it and because the owner had located a source of fishmeal for his chicken food, these eggs had a definite flavour of the sea!

It was not until the 1950s and '60s when immigrants began to arrive from the Indian sub-continent, buying up almost all the terraced housing which lined much of Wood Street, and almost all the other streets in the area, that we began to live in a world with the constant smell of curry. We deduced, from the crates of live

chickens being delivered two or three times a week to the cellars of these houses, that chicken and curry went together but never a dish I ever tasted at home as it was regarded as “far too spicy for us”. From the electoral register it was clear that all these, two up and two down terraced houses, with only outside toilets and no bathrooms contained 25 – 35 men who slept in shifts to match the 6am – 2pm, 2pm– 10pm. 10pm – 6am work patterns of all the local factories.

These new immigrants replaced the original inhabitants who moved to new council estates or tower blocks, leaving behind these small terraced houses with long gardens and each with a pig sty. I still remember fat pigs being chased up the road on their way to the local butchers from their domestic sty, to return later as sides of bacon. During the war years many people kept chickens and pigeons as a source of off ration food. Our neighbour, mother of my friend Brian, kept chickens and supplemented their allowable food ration by collecting neighbours’ potato peelings and boiling them with meal as a mash – nothing wasted! With the change in population came a change in the nature of the area. No longer did neighbours just pop in and out of each others houses and the annual Sunday School Anniversary morning processions from each of the local churches and chapels, led by a Boys’ Brigade band, and followed by dozens of adults and children in their Sunday best, stopping here and there to sing a hymn, became just a memory.

The 1950s and 60s the giant metal working factories of the West Midlands, each employing up to thousands of people, were in their heyday, F H Lloyd, Guest Keen & Nettlefolds, Patent Shaft, Bilston Steel Works, and Rubery Owen to name just a few. The factories within a mile of so of home punctuated the day with differently pitched sirens, which we called bulls, which marked meal times and changes of shift, sounds to which we, as children, would respond such as “that’s GKN’s bull, it must be dinner time”. When I lived in Park Lane my bedroom overlooked the road and directly opposite, not 50m away, was F H Lloyd’s, sand blasting shop, where giant steel castings were rotated in an equally

giant metal drum while being cleaned with a high pressure blast of fine sand. The noise was, in retrospect, almost deafening and continued day and night for 20 shifts per week and I slept less than the length of a football pitch from it. But it was that one maintenance shift per week, over Saturday night, when the silence made it difficult to sleep, although the workmen leaving the Park Lane Working Men's Club next door to our house often broke the silence, and not infrequently Irishmen, far from home, would sit on our front step, a step worn down by generations of knife sharpening by a previous lady of the house, and sing through their tears, "When Irish Eyes are Smiling". Although licensing hours were strict and "time" was called at 10pm, dehydrated furnace men from F H Lloyds would have a couple of pints of beer set up and awaiting them after the 6 – 2pm and 2 – 10pm shifts. A decade or so later these great factories and the Working Men's Club, had gone or were a shadow of their former selves and F H Lloyds "the biggest steel foundry in Europe" became the site of one of the first IKEA super stores in England.

Just 50m down Park Lane from my house, once called Sparrow's Forge Lane, was a large patch of open ground later fronted by a row of new council houses and which we knew as "the field". This was probably a bit of the old Falling's Heath coalfield, for the upper half of the field was covered with 10m high coal mine waste tips with one steep face, just right for negotiating on a bike or scooter. Care had to be taken not to leave the track down the grey clay tip and end up in a small drainage stream emerging from a collapsed adit at the bottom of the slope and which quietly trickled its way round F H Lloyds and on in to the River Tame about half a mile away. I remember on a number of occasions, one or other of the children playing along the stream would find the short ends of tallow candles washed from deep underground and used by long gone miners to illuminate the coal face, a real connection with the area's past. One of the things I love about the Blackcountry is its history and industrial archaeology, whether as tangible as a tallow mine candle or in street names, the past is always there. There are streets and roads named after the great eighteenth century

minemasters such as Sparrow, Gower, Crewe, Wood, Sneyd, Cook and Barlow as well as street names linking to social history such as Cobden, Bright, Gladstone, Salisbury and Franchise Streets.

Thinking of Wednesbury days, a host of little things flood in to memory. These were the times when I was proud of my Hornby OO train layout, played marbles and jacks (a catching game) and watched Muffin the Mule on Les Harvey's, the local scrapyard owner, television – the only one on this part of Park Lane at the time! Rag and bone men with their horse drawn carts collected any sort of scrap with the cry "Any old iron?" Gypsies would come round selling pegs for the washing line and would often curse you if you didn't buy; Whites' ginger beer was delivered weekly in stone bottles; evenings were sometimes spent helping my mum to "bodge" a hearth rug, by threading cut strips of rags on to a hessian (sackcloth) backing; almost all houses had a piano and often a treadle organ, but these were largely unplayed leftovers from a previous generation when there was no broadcast entertainment; but the Victorian hymns and parlour songs were still often sung at home and I still know many of them to this day; the backs of arm chairs and sofas were covered with antimacassars, cloths originally intended to keep macassar (hair) oil off furniture; the walls of the living room, front room and hallway in Wood Street were literally covered in framed pictures to within a metre of the ground as was the fashion of the day, as it was to have a small conservatory full of just geraniums and rather boring, green leaved aspidistras – although of interest to a botanist like myself as they do occasionally have inconspicuous flowers at their base pollinated by slugs!

I remember hot water bottles and bed warming pans in the freezing cold bedrooms and a po or gusunder (chamber pot) under the bed, the contents of which often froze in winter – not quite en suite; my mum using a dolly, a large wooden block used for pounding the clothes in the washing tub in pre-washing machine days and the subsequent process of putting all the clothes through two heavy wooden rollers of the hand cranked mangle – a good job for a lad with too

much energy to burn; using Zebo black lead to keep the kitchen range in drab black but shiny condition; buying sugar loose in blue bags as well as loaves of sugar and blocks of cooking salt. There were effectively no freezers so surpluses of fruit and vegetables were preserved in Kilner Jars or as jam and all our spare runner beans were picked, sliced and salted down for winter; in spite of rationing there were gob stoppers, boiled sweets which changed colour as they were sucked, bought from the boiled sweet shop – a child’s delight; the excitement of the day rationing ended and I bought my first 3d Dairy Milk chocolate bar without coupons. Liquorice sticks (root) were bought from the chemist, which were full of flavour and could be chewed, calorie free, for hours; the shortage of fruit usually brought a group of lads around anyone lucky enough to be eating an apple to beg for the core; there were school outings to places such as Rhyl and Llandudno on specially chartered trains and we had the freedom to wander for miles without the fear which haunts children and their parents today.

Living as I now do in a land where many Welshmen speak “the language of Heaven”, I have only recently realised, in retrospect, how special was the language of the Blackcountry of my youth. Every village/small town in the area had a subtly different accent and I could usually pick out “outsiders” from Willenhall or Wednesfield or Wolverhampton from my native Darlaston or Wednesbury stock. It wasn’t just the accent but the dialect which remained common in my youth and which I thought of as just part of my natural vocabulary which made school teachers despair. Many words and phrases came from ancient Middle English and included many thees and thous. Although I must admit I spoke fairly standard English but with a strong Darlaston accent, I would be frit if I was frightened, give someone a lamping or pailing if involved in a boyhood fight, cod people if I was joking, call a fire place an ess’ole, be clemmed if I was hungry, someone was noggin-yedded if stupid, blarting if in tears; if someone irritated you they were mythering and mothers would get their children to hold their donny (hand) when they crossed th’oss road. Conversations along the lines “How are you?” “Fine”. “I’m not going home yet because I have not seen

her” would be “Ow b’ist gooin?” “Bostin ar kid”. “I bay gooin wum yet cus I ay sid er”.

“Ar” was “yes”, “bay” was “not” “can you” was “cost” and “goodbye, see you soon” was “tararabit”. A common saying if rain threatened was “Its black over Bills mothers”- I never found out who Bill or his mother were! After university when I returned to teach in the area many of the white kids seemed to have had dialect taught out of them and softened their accents leaving the real Blackcountry twang to the new generation of mainly Indian origin showing how language can adapt to changing times.

The Tame

To understand why I count this river an important element in my early life you must first understand something of the river itself. The River Tame which drains an area of some 1500km² is the major river of Birmingham and the Blackcountry and the most important tributary of the River Trent, indeed at its confluence it is a larger river than the Trent. It has two arms, the Oldbury arm and the Willenhall arm, which join at Bescot, just south of Walsall. The Willenhall arm flows through my part of the Blackcountry and has, since my youth, been culverted and canalised largely due to the impacts of decades of industrial development and the construction of the M6 motorway and is now rarely easily seen. The river has many claims to fame, although once, before the industrial era, it was a salmon and trout river, it was, until well in to the second half of the twentieth century, one of Britain’s most polluted rivers draining the most heavily urbanised river basin in the UK. It has been said that it used to take the effluent from 400 – 500, often inefficient, sewage filter beds on its journey through the area, but the growth of Birmingham and the Blackcountry overloaded the sewage system, causing pollution so severe that, by 1918, the river held no fish and by 1945 virtually no aquatic life.

There is a link between the problems of the Tame and my adopted hills of mid-Wales. Birmingham found that pollution had not just affected surface water but also the ground water sources from which the area obtained much of its public water supply. To solve this problem and its associated water-borne diseases such as typhoid, cholera and diarrhea, Birmingham City Council built the reservoirs of the Elan Valley in the Cambrian Mountains of mid-Wales, providing its urban population with 100 million gallons (c450,000 m³) of clean water per day. But this created a problem as it increased the base flow of the Tame and exacerbated the river's pollution problems. So bad were the pollution problems of the Tame that a complex of water purification lakes were constructed downstream at Lea Marston, a solution unique in Britain. The good news is that today the Lea Marston lakes have become the Kingsbury Water Park and in the Sandwell Valley downstream of Bescot, wildlife flourishes in this part of the river's valley. But, in the heart of the Blackcountry, there are still no sustainable fish populations in the Tame although there may be some summer growth of aquatic vegetation.

In my youth the Tame was polluted, not only with sewage, but also the waste of heavy industry, including heavy metals of all sorts, oils, cyanide from hardening steel, degreasing agents such as carbon tetrachloride and the polluted mix of salt and oil and even asbestos from the brakes of vehicles all washed off the roads. Among the children of the area it was commonly believed that, if you fell in to the Tame you would never drown as it was so toxic it would kill you before then! This was probably not far from the truth.

Memories can take many forms and for the Tame for me it is one of smell, for wherever I encountered the river the overwhelming smell was of oily sewage, whether from the waterway itself, its floodplain or from the almost ubiquitous sewage treatment works which in many areas lined its banks. In spite of the often lung destroying fumes of heavy industry, there is another smell which comes to mind mingled with the sewage. On the sewage-farm lined road over The Lunt

between Darlaston and Willenhall was the odour of the so-called “Potted Meat Factory” or Butchers Skin, Hide & Wool Factory by which it was officially known. The smell of decomposing flesh could be detected half a mile away and I recall as a boy once visiting the factory and reaching for a thick black pipe to find that as my hand reached it, it dissolved to a thin copper tube as the covering of flies melted into a flying swarm. To maintain fly numbers it is not surprising that maggots were at least as numerous as flies. What would modern environmental health regulations have made of the place? I came across this brief quote from a letter in The Blackcountry Bugle about memories of this same factory:

“We would get maggots to go fishing from the meat 'plaece' and knowing Jack Thomas, he would let you help yourself from the huge pile of ground bones which was surrounded by the constant march of millions of maggots encircled above by the same amount of flies.” Ahh, memories memories!

The Blackcountry now seems to be, at least to me, an almost continuous swathe of built up land, but in my youth each of the towns which make it up was separated by what euphemistically was called a green belt, but could be mine waste, old quarries, polluted flood plain, a little poor pasture possibly with a horse, sports grounds, cemeteries, and because these were areas remained open and formed a continuous belt, if not a green one, they were followed by the railways and canals. Through many of these buffer zones between the edges of adjacent towns, ran the fragrant aquatic “belt” of the Tame or one of its tributaries, which was a main reason for the persistence of these unbuilt-up areas, the antithesis in my time there of the present concept of “green”.

Before the advent of television, children like me would listen each day to the radio (more generally called the wireless) especially to Children’s Hour on the BBC Home Service, with the likes of Uncle Mac, Larry the Lamb and Nature Parliament. It was the latter which always interested me and from an early age. I did not want to be a train driver or enter “a good paying job” in local industry as I was encouraged to do and football never really interested me, I wanted to be one

of the panelists on BBC radio's Nature Parliament answering listeners' questions on natural history topics. Logic might have said "how can a lad from the most industrial and polluted of landscapes possibly have such natural history ambitions?" I did have a few things on my side; my time by the Severn which I will come to later; the tolerance of my family to my interests; the role model of my mother in her love of reading and writing; the books from Wednesbury town library and last but not least the valley of the Tame and the unkempt nature which flanked its banks was my hunting ground. Wednesbury public library, just down Squire's Walk from St Bartholomew's Church where five centuries of Slaters were baptised, married and buried, was a second home to me as it had an excellent natural history and reference section. The books I borrowed were the identification guides of the day together with countryside-based story books by "BB" and Romany and imagining one day perhaps it would be me watching the rooks at dusk or tickling trout in a crystal clear river somewhere other than the Tame.

The Tame itself had no life in it except perhaps briefly in the bags of unwanted kittens which disappeared into its chocolate brown, oil swirled waters, but the flashy nature of its flow, due to rapid run off from roads and impervious surfaces, meant that it frequently flooded over nearby land creating areas of oily, smelling, thickets of coarse reed canary grass and everywhere the occasional buddleia bush, a good place to spot the relatively few butterflies which dared to frequent the area.

But, not far from where the canal crossed the river on the road from James Bridge to Bentley was a special place. But, that times were tough for some families, could often be seen here as two or three people were almost constantly on the canal embankments looking for coal fragments deliberately thrown out to them by the passing canal boats heading to the candle factory or loaded with coal or iron. But, what made this section of canal special, was that one of the factories used water from the canal for cooling and returned the same slightly

warmer water to the canal and where it entered the canal you could catch guppies and zebra fish, outcasts from tropical fish tanks, now living in temperature defined freedom. Maybe it was this fleeting contact with exotic fish which fired my enthusiasm for tropical fish. In my youth there were aquarists' shops in every town and it was quite easy and usual for me to spend a day on my bike visiting half a dozen such shops to see what new stock they had received. Over time I kept nearly all the usual tropical fish in my Fish House, an outdoor brick building, once the utility room of modern parlance, lined with aquaria. As well as the routine fish which are still the life blood of any modern aquarists' shop, I remember keeping some slightly more exotic species such as electric eels, lungfish, mud-skippers, axolotls and tiny *Clarias* catfish which grew at a ridiculous rate, ate everything else in the tank and on reaching some 25cm it was almost impossible even to give them away! I didn't do tropical marine but I did keep a tank or two of native sea shore life which even stimulated a local group to be established devoted to native marine fauna. Aquarists' clubs were abundant and I belonged to the club at Guest Keen and Nettlefolds factory which had monthly talks, fish shows and inter club competitions. An interesting character around at that time was a fish keeping GP, notorious for having served time in jail for fraud, who was always happy to give a NHS prescription, often for antibiotics, to help cure an outbreak of disease in the aquarium. There are aquarists' shops still around but they are fewer and mainly found in garden centres and I no longer know any "helpful" GPs!

Did this aquatic interest have a lasting influence on me? Yes, I think it did. When I began to teach, I had the chance to visit Malvern College where the great biology teacher and text book author of his time Arnold Darlington taught. I had read how he managed to persuade an inner city school with Victorian buildings that real ecological studies were possible even in the most unlikely situations. In this case by utilising the broken overflows of the boys' outside toilets to study tiny tardigrades (Waterbears) living in the moss and algae growing on the water soaked outside wall. At Malvern things were not that simplistic, the students

worked on six days per week and staff members, we were told, were usually available until 10pm every night. They had a genetics garden where they repeated Mendelian genetic experiments, and when I was there they were hybridising foxglove species and doing genetic experiments in large aviaries with Javan sparrows. We were taken to Hope End estate near Ledbury, the childhood home of Elizabeth Barrett Browning, where at the time Malvern College had its own nature reserve. In my state school I taught my A level biologists for six lessons per week with only limited facilities, but by using my knowledge of aquarium fishes, I was able to replace Malvern's Javan sparrows to demonstrate the inheritance of various genetic traits utilising live bearing fish such as mollies and guppies and with various goldfish I could show the extreme forms of selection - I even used these examples when I returned to teach at Aberystwyth University – so not a totally wasted youth!

Darlaston, where I taught, was also the home of the Ward plant pot factory and after some time teaching there I realised one of Ward's old and flooded terracotta clay pits was islanded by houses just yards from the school giving me the opportunity to try to pass on my enthusiasm for ecology to town-bound pupils.

Another early connection with the animal world was via Dudley Zoo which I visited regularly as it was only two bus rides away and although zoos got a bad press before they were seen as the saviours of some species, they were where a lad like me could see and hear and even smell exotic wildlife. At about this same time I remember Chipperfields' and Billy Smarts' Circuses visiting and parading their elephants and horses through the towns with their caged lions and tigers leading lives which today we would find totally unacceptable.

The course of the Tame was a wildlife corridor before the word became de rigueur in the conservationists' lexicon. It was through this unkempt countryside that the urban foxes of the Blackcountry travelled their world and became more frequently seen as time went by. Not infrequently, as a biology teacher, a proud

pupil would arrive at school with a dead fox, usually shot in the act of attacking the family's chicken pen, with the request for a dissection demonstration.

A street of terraced houses, many with just a small cobbled yard and a detached wash (or brew) house (brewus) and no garden, may not be the first place you would think of for a person interested in wildlife, but if I called in to see Mr. Horton in the Post Office on the corner of Cobden Street and the Walsall Road, his wife would make us a cup of tea each, and we would go out of the back of the shop through a glass roofed veranda connecting through to the wash house and here was a collection of orchids such as I had never seen before and beyond them, entering and leaving the wash house through their own brick-sized entrance, were his bees. Except for the orchids, which did not need his bees for pollination, the bees lived in a high walled yard without a flower in sight. On some occasions when I visited, Mr. Horton would say "There's been a funeral at James Bridge cemetery, just look at the bees" and sure enough the usual yellow pollen loads of most of the bees was now being supplemented by pollen of different shades collected from their necropolitan floral tributes. Years later I became a bee keeper in Wales but my insects foraged the estate gardens and the open countryside on a no less varied but more conventional range of flowers.

There's one bit of Blackcountry natural history that is difficult to beat and that's the trilobite fossils particularly in the Wenlock limestone of Wren's Nest hill near Dudley. So frequent were they in these rocks that the eighteenth century quarrymen called these *Calymene blumenbachii*, "Dudley Locusts" and so famous did they become that they appear on the Dudley County Borough Council coat of arms. I always enjoyed fossil hunting, from plants in coal i.e. hunting in our coal shed, to shells in limestone, and when at school, my friend Mike Jones began to study geology, he said he knew of good fossil site in Walsall, and so I was introduced to the Daw End Railway Cutting now a Site of Special Scientific Interest and said to be the best exposure of Wenlock Shale in Britain. To us in the early 1960s it was just a fantastic fossil site, accessed illegally through the

railway fencing and searched with one ear cocked for approaching trains which necessitated a rapid retreat. We didn't find trilobites here but fantastically preserved brachiopod sea shells just fell out of the shale after 400 million years of preservation. My prize find from the site was a sea lily which I sent to the Natural History Museum in London for identification and they were so impressed that they asked to keep it for their own collection – and there it resides to this day, my contribution to science at an early age. Mike later went on to become a professional geologist heading the Geology Department at Leicester Museum.

The best bits of nature along the route of the Tame were the deliberately constructed pools such as the Box Pool which F H Lloyds' Fishing Club owned in a triangle between the railway where it left James Bridge station, the Walsall Road and the river Tame. Here were coarse fish, but I never found out much about them because access for non-employees was not encouraged, and birds such as swan, coot and moorhen lived safely in the pool's relatively clean water. Following along the side of the river past the Box Pool, was a path originally over rough grassland with skylarks and field mushrooms, the first place where I found nests of the former and first picked the latter, which formed a short cut from my home to my grandmother's, a grassland which eventually became the site of two enormous gas holders and ultimately the M6 motorway. At the end of the Box Pool the river went under the railway to flow through open land used as a tip by F H Lloyds, (now a retail park) but the path continued alongside the railway towards Pleck Park. Before reaching the park was a narrow pool some 30m by 5m which probably connected beneath the railway to another pool in the corner of the park. This was a marvelous place for pond dipping and always seemed to be full of life in spite of its regular harvesting by boys with nets and jam jars. Here I first saw great crested and smooth newts, dragonfly and great diving beetle larvae. Half a mile downstream, the Tame valley flowed past the Eleven Arches railway viaduct where there were more pools and wetland to explore not far from the confluence of the two arms of the river at Bescot. Today the Eleven Arches wetland is the site of a secondary school.

Bescot was a great spot for train spotting (particularly on cross-country runs from school) as it was both a marshalling yard and had a through railway with named railway engines (namers) passing by every few minutes it seemed. These engines would be ticked off in my I Spy book to be added to the lists I regularly collected from the main line at Milford on the far edge of Cannock Chase. At Milford I got to know the signalman at the nearby and very busy Colwich Junction and to a young boy an invitation to visit to such a signal box was a memorable event.

Also at Bescot was one of the many sewage treatment works which lined the river valley and it was from their settling beds that Walsall Council collected its “top soil” for the gardens of its new houses. When my grandmother moved into her old people’s bungalow in Gower Street, the council kindly covered her whole front garden and those of her neighbours with this “top soil” which for months smelt very strongly of what it mainly was, and, as if to emphasise that fact, the garden was soon covered with metre high vegetation entirely made up of tomato plants – which cropped remarkably well! As a budding biologist I learned an early lesson that tomato seeds germinate best once they have passed through the human gut!

It wasn’t just the Blackcountry water and soil which was polluted, so was the air. As a child I suffered badly with asthma and other breathing problems, to the extent that one of my first memories at the age of four or five was thinking I was about to die of an asthma attack, the doctor was called and I clearly recovered, but my parents were told to get me out of the polluted atmosphere as much as possible and from this began my association with the Severn. These were the days of “pea souper” smogs (a word derived from smoke and fog) when literally, it was impossible to see further than your feet. I lived only a mile or so from school so had no great commuting problems, but when the smog came, all public transport stopped and those children living up to 20 miles from my secondary

school just had to walk home. So polluted was the air that a handkerchief wrapped around the face became black within a few seconds. Some years later clean air legislation consigned smogs to history. On occasions an air inversion would drive smoke from Partridges Copper Works – a factory a mile or so northeast of F H Lloyd's - down on to nearby gardens killing every plant in sight. I remember on one occasion walking through the allotments on the way to my grandmother's and seeing a 100m wide, brown swathe of dead crops and hedges cutting through the gardens, all the work of a single dose of copper works smoke. Knowing the effect it had upon my health I often wondered what effect this sort of pollution had on other people's lives, as similar fumes came from F H Lloyds and other factories, and the immigrant populations seemed particularly prone to suffer respiratory problems with sometimes fifty coughing people queuing out from the surgery and far down the road to see the single GP. Where I live now, windows get cleaned at best a few times a year, but in Wednesbury, windows were cleaned outside every week, and so bad was the pollution that our glass veranda roof was cleaned every other year with hydrofluoric acid, the only substance capable of dissolving the surface layer of the glass to remove the etched in pollution of industry.

One of the smells I remember from my youth, when going through the allotments or past garden hedges, was that of wet soot which I thought was the natural smell of the ubiquitous privet hedge. Sometimes nature seemed to take advantage of some of the area's "problems". Because its food plant was so common and almost indestructible, one of the moths we used to regularly find was the privet hawkmoth and its caterpillars, and on the acres of rosebay willowherb, which covered lots of our waste land, the scarily eye-patterned caterpillars, of the subsequently beautiful, elephant hawkmoth were often victims of the collecting jam jar after a child's expedition into the willowherb jungle.

Going to school in this area saw me first attend the then almost new Albert Pritchard Infant School built in 1938 in Crew Road, Wednesbury, which was

chosen for me rather than the Victorian buildings of King's Hill Junior. At Albert Pritchard I reached the dizzy height of school milk monitor, having a four wheeled trolley to deliver each day the one third of a pint bottle of milk for everyone in every class of the school. After Infants it was then the overcrowded Wood Green Junior School, built 1931 in nearby Hobs Road, where there were 65 children in my top class taught by one teacher. Of these, I seem to remember about eight passed the eleven plus and went on to Wednesbury Boys or Wednesbury Girls High School, the rest including me were destined for a non-academic education in the local Secondary Modern Schools. In other places in the country over a third would be offered high school places but, as I found out in my later days as a teacher, leaders of Midlands' industry did not want too many children, particularly girls, to be well educated as it diminished their source of factory fodder.

As an eleven plus failure I went on to King's Hill Secondary Modern and quite enjoyed the practical slant particularly gardening and bee keeping but I've never come to terms with woodwork or metal work, so it was probably a good thing for me when, after a year at King's Hill, I took and passed my 12+ and secured one of the eagerly sought places at the County Commercial Secondary School at Wood Green in Wednesbury. This was one of the few ways to escape the Secondary Modern route and each year children from a 20 mile radius would vie for the 25 12+ and 50 13+ places – and I made it first time of asking.

I had no intention of making commerce my career, but this, for me inaptly named school, did have a commercial stream, a technical stream and a grammar stream and this latter was the one for me. Through time, the school eventually became Darlaston Grammar Technical and later just Darlaston Grammar School in preparation for its eventual move to new buildings in the neighbouring town. We took great delight as 11+ failures in outdoing the nearby Wednesbury Boys High School when it came 'O' level and 'A' level results, and in comparing how many went on to university and other forms of higher education. We always did far more 'O' levels than needed, almost like stamp collecting, and my 14 'O' level

subjects plus my 'A' levels got me to Aberystwyth University to study for an Honours degree in Botany with subsidiary Zoology and this was where the ecologist in me was finally let loose. With my 2i degree in Botany I decided to return to the Midlands and earn my living as a secondary school biology teacher.

By this time my old school had uprooted from its old house and prefab accommodation in Wood Green Wednesbury, to become a 12 form entry, (roughly 1500+ pupils), Comprehensive School, in brand new buildings in the Catherine's Cross area of Darlaston, near where my great grandfather had his gunlock filing workshop. So, in essence, I had returned to my old school to teach in my family's old stomping ground. I stayed there for four enjoyable years before, in 1970, I returned to Aberystwyth University as a Demonstrator (Assistant Lecturer) in Botany in order to teach and concurrently study for my doctorate in peatland ecology. While teaching I had gained by University of London Postgraduate Certificate in Education and a Master of Science degree for a study of Wem Moss in Shropshire.

The decision to go back to Aberystwyth was a difficult one as I was enjoying life as a teacher, had Head of Year pay and responsibilities, and had concurrently been offered the Head of Biology job at Wolverhampton Girls High School. My choice was, to stay in teaching for the rest of my career, or see if I had a way forward in Higher Education. The attraction of the Wolverhampton job, after years in a comprehensive school with a full spectrum of abilities, attitudes and backgrounds, was that the Wolverhampton still had selection at 11+ to six schools and a second level of selection from the first creaming to the separate Boys and Girls' High Schools, academically the *crème de la crème*, and as I enjoyed teaching my subject, that would have suited me fine – but I realised that if I didn't take the opportunity to go back to do a higher degree at this point, then I would never be able to afford to do so, so the young ladies of Wolverhampton never had the pleasure of my teaching!

The Ystwyth

My time working at Aberystwyth was effectively four years by yet another river, as I lived for much of the time with Liz, my future wife, in an old cottage in the parish of Llanilar (but over the river from the village itself) and not more than 50m from the Ystwyth. The Ystwyth is, in many ways, a strange river, half way between the pollution of the Tame and the purity of the Wye. In times of severe flood the waste from innumerable mine tips washes in to the river lead, zinc, copper and most of the other toxic metals you could wish to name. The effects of such events were to cleanse the river of almost all animal life leaving the post-event clean water to gradually recolonise from the side streams, so that once again trout and even sea trout ventured back in to these waters in a cycle of extinction and rebirth.

Until the 1960s the only railway to run south of Aberystwyth went along the Ystwyth valley opposite my cottage and on across Tregaron Bog (Cors Caron) buoyed up across the wet peat by bales of wool from the flocks that have grazed the hills for at least 1000 years since monasteries existed at Strata Florida near Tregaron and Abbeycwmhir in the Wye catchment. Such bales were the nineteenth century equivalent of the geotex membranes, which stabilise modern day constructions. However, when I lived there, all that remained along the route of the old railway were concrete distance markers two of which eventually adorned my garden. My old cottage was called Ffynnon Drindod (Trinity Well) and where the water emerged from the hill slope, a coffin shaped stone bath had been constructed where immersion would allegedly cure skin and eye problems. Its use as such had fortunately long gone before it became my water supply! Being inquisitive and having sophisticated analytical facilities available in the university, I had the water analysed to find its magical properties only to find it to be the purest of pure water with no secrets. But some old practices still remained in the valley, and in low summer flows the bed linen from the farm opposite would be put into the bed of river for several days, held in place by several large stones, as a natural washing machine, a practice that had endured for generations.

In the days when I lived there, the red kites nesting in Wales were in single figures, but one of them nested within a 100m of the cottage, a feature visitors treated with excitement, but to us lucky people it became a mundane and everyday experience. Similarly exciting was that, for one whole summer in 1973, corncrake occupied a hayfield immediately opposite the cottage on the far side of the river, and its call was a constant companion though that period. It is likely that it nested there, and was one of the last summering corncrakes recorded from Ceredigion. My job at The University College of Wales, Aberystwyth (notice the essential definite article as it was here in Aberystwyth that THE University of Wales began) was to lecture to students and to guide them through the mires and mountains, sand dunes and sea shore of central Wales, studying the ecology of each habitat. At the same time I conducted research for my PhD into the surface vegetation of the peatlands of the area from Borth Bog (Cors Fochno) on the Dyfi estuary to the blankets peats which cover most of the west facing hills on this western seaboard of Europe. It makes me realise how long ago this was as Concord, our only supersonic airliner, was still being tested over the Irish Sea and its sonic boom was a regular sound to accompany me on an otherwise very silent Borth Bog save, that is, for the several hundred Greenland white-fronted geese, who, at that time, still came to the bog in winter to feed mainly on the bulbils of the white-beaked sedge. Today only Canada geese not Greenland white-fronted geese honk over the area and Concorde is now a museum piece.

My teaching at Aberystwyth was not limited to the lecture theatre but extended beyond the classroom to helping lead field courses in Wales, Yorkshire, Hampshire, and even (unusual in those days) as far as the Burren in western Ireland. Working with students around Aberystwyth was always exciting as you never quite knew what you would find, on marine biology courses particularly off the College Rocks, students occasionally managed to find species such as octopus or exploring the orchid rich early summer flora of the sand dunes at Ynyslas there always seemed to be new plants to be found and new scientific

names to be memorised. Our field courses variously took in Malham Tarn Field Centre, in Yorkshire, a must see classic for all good botanists, and the former Kings' College, London Rogate Field Centre on the South Downs, as both offered in their limestone and chalk respectively, a complete contrast to the acidic soils of much of Wales.

Visiting the Burren in western Ireland was good for the students' environmental and social education. This particular year Dr Andrew Agnew was in charge of the University's Long Wheel Base Land Rover and I took charge of driving the hired eleven seater minibus. All went well on that Sunday morning until we reached Kilkenny, not far in to our journey across Ireland, when the Land Rover developed a fault. Enquires in the town found a man who diagnosed the fault as a failed fuel pump and yes, he had one in stock and could replace it quite easily. That was a relief, so we asked him to get on with the job. But we forgot we were in deepest Ireland and no-one there worked on a Sunday. There was nothing for it but for Andrew and one other person to wait on the car park overnight and catch us up next day. They had a rather dull time except that at 3am the Land Rover door opened and a man got in to the passenger seat asking if the bus to Dublin was ready to leave!

The rest of us, i.e. the original eleven in the minibus plus the five displaced from the non-functional Land Rover became sixteen for the day's ride across to the west coast and Lisdoonvarna. Fortunately the minibus had a bench seat for the driver and two passengers, but by morphological selection we got five on the front seat provided I kept my right arm out the window. The middle person had the job of changing gear on my instruction and the unfortunate girl sitting next to me gave her permission for me to indecently assault her whenever I needed to apply the handbrake. The person occupying the foot well needed straightening out every few miles. After this minor hiccup the course went well to the sound of Irish music and learning the patience to wait for a glass of real Guinness to fill. Our lab, however, was unconventional, as we were offered a meeting room

clearly, from the literature littered about, the base for the local IRA. To connect up our microscopes, the proprietor showed us how to connect them to the bare live wires which hung from the ceiling, having first torn the electrical plugs off the instruments themselves. I hear the reader saying "Risk assessments?" and I would reply, "We did tell the students to be careful". How things have changed!

Before I moved to Llanilar, I lived in a flat in Aberystwyth owned by Mr. and Mrs. Rees as part of their Bed and Breakfast business. I had previously known the Rees family when they owned a farm on the Mynydd Bach just south of Aberystwyth before they retired to a "less demanding" life. They did however bring with them some influences from their former farming life. Their first language was Welsh, but asked if they watched much of the Welsh language television channel S4C, "Bloody rubbish bach, always watch ITV". In the Second World War they took in a very young evacuee from London who had learning difficulties and who subsequently stayed with them as a servant (all farm workers were "servants") and is the only person who I have ever met who could only understand and speak Welsh.

Other former "servants" from their farming days used to come and stay from time to time. One used to suffer severe nightmares and sleep walking. On one occasion Mrs. Rees heard someone in the kitchen in the middle of the night and then the front door opened and closed. She and her husband rushed down to find their boarder half way down the road in his pajamas carrying his lunch bag on his way to work. He was however fast asleep, and on returning to the house he had no recollection of making his sandwiches and heading off for work. On another occasion, from my top floor flat, I heard a loud noise followed by raised voices and the following morning asked what had happened. "He had a nightmare of being chased by a bull so he tried to hide in the wardrobe which unfortunately fell forward on its doors and the noise was caused by us trying to get him out".

Mrs. Rees still fed people as if they were still on the farm and if I was around on a Sunday she insisted on feeding me. If I didn't manage to escape the full day feeding regime was a full cooked breakfast, mid-morning coffee and sandwiches, a three course lunch which had to include "meat" so if it contained roast chicken there was also a lamb chop, mid-afternoon tea and cakes then supper which was meat and two veg and a pudding followed at ten o'clock with a drink and sandwiches. One day a couple arrived with their ailing father Mr. Jones who was not eating well. However, Mrs. Rees believed she had refound his appetite and got him to eat a big cooked dinner and sent him off to bed with mulled stout. Again there was much noise in the night and in the morning I was told Mr. Jones had died in the night - I still wonder about the cause of his death!

It was during my time at Aberystwyth that I first began to achieve my childhood ambition of appearing on Radio Four's Living World the successor to BBC Home Service's Nature Parliament – an association with broadcasting which lasted almost two decades, before the fickleness of the media moved on to other voices.

As my contract ended at Aberystwyth, like buses, I waited some time for job offers then several came at once. I was simultaneously offered the choice of three jobs, one in the University of Bath as a lecturer in the School of Education, one as a Senior Lecturer in Ecology at the then Nottingham Polytechnic and a third just over the hills from Aberystwyth in the Wye Valley. I took the job offered by the University of Wales Institute of Science & Technology, UWIST for short, as the Curator and later Director of their newly established field centre at Llysdinam near Newbridge-on-Wye. A married couple was required for the job so Fred and Liz became Dr and Mrs. Slater! But this gets me too far ahead with my story as I have so far not mentioned the Severn, the next of the rivers of my story.

The Severn

Living in a damp house within a heavily polluted industrial landscape, my young lungs suffered bronchial problems and severe asthma, to the extent that one of my earliest memories, which I have already recalled, was that aged four or five, I thought that was going to die during a particularly severe asthma attack. Our GP advised that for the sake of my health we should move from the area or it would probably kill me, but that was not possible so the family decided to get me away every weekend and during holidays to an atmospherically cleaner environment. To do this my father and uncle spent all their spare time building a caravan which we took to Shropshire, first to the Royal Hill Inn in Edgerlerly and later to Cae Howell Farm just further up the road, where the Davies family treated us as extended family for the next 50 years. Both these locations were within 100m of the River Severn which, at this point, was some 20m wide in low flow and a kilometre wide when in flood. The river here is always turbid and generally deep and a mile or so upstream from Cae Howell receives the waters of a major tributary, the Vyrnwy. Along this section the river is the border between England and Wales our caravan being on the English side looking across to the almost deserted Welsh landscape of the Loton Park estate.

It was here from the age of five that I learned about farming and the countryside. My dad and uncle often spent an afternoon hunting rabbits on a hill farm above Oswestry, a few of the animals retained for us and the rest to help neighbours back at home to eek out their post-war meat rations. I was the retriever bringing the lifeless rabbits back to our collection point and it always fascinated me that perhaps ten percent of this rabbit population was black, an interesting observation for which I waited until my university days for a genetic explanation. Similarly, to help out with rationing my mum used to bring back several dozen eggs each weekend to be distributed locally to our neighbours.

In those days Cae Howell worked with two Shire horses, Tip and Lady, and my mum was often concerned to see her five year old leading one or other of the two massive horses in case he was squashed beneath their hooves – but they were

gentle giants and my toes remained unharmed. All the fields in those days were used for grazing or rested in spring for a hay crop to be taken before the field was grazed again mainly by cattle from late summer. While the horses remained, one field was given over to oats to feed them. All the fields were rich in flowering plants, drifts of cowslips in the open fields with primroses under the hedges, not to mention the hybrids between the two, which we then incorrectly called oxslips, and it was walking these fields with my mum that I first became interested in wild plants – perhaps my first steps towards my first degree in Botany. The most exciting time to walk the fields was late summer and early autumn when field mushrooms were abundant as were horse mushrooms, ink caps, giant puffballs, parasol mushrooms, as well as the other edible bounty of the autumn hedges and orchards. Although a few primroses still remain, the cowslips and most of the mushrooms have gone as agricultural practices have changed.

I spent much of my time coarse fishing in the river while dad and Maurice fished for salmon. None of us were great fishermen, but I was really interested in catching as many different species as I could, sometimes with rod and line, but also with my minnow trap made from a Martell brandy bottle with the dimple in the base carefully knocked out to form a funnel. As a “trainee” naturalist my botanical and piscatorial knowledge rapidly expanded during this time.

A one time licensee of the Royal Hill Inn, Griff Phillips retired to a bungalow between the pub and Cae Howell, and in his old age I got to know him quite well, even though I was only perhaps about ten years old and he was in his eighties, as I think he wanted to pass on some of his skills to an interested member of the younger generation. His bungalow had cases of stuffed creatures, some genuine and others almost convincing bird “hybrids” due to the undoubted skills of the taxidermist and in his shed he was always proud to show you his coracle said to be the last one used on the mid-Severn. Not to put too fine a point on it, Griff in his younger days was a poacher, said to be one of the best on this part of the Severn, with a terrific knowledge of wildlife and the skills to catch it. The coracle

would take him up and downstream laying night lines for salmon and eels. Eels were so abundant in those days that visiting fishermen would fish conventionally overnight in one famous deep pool on the river and go home with up to a hundred eels at day break. Keen to learn and try out Griff's (largely illegal) skills he taught me how to attach multiple hooks to a nightline, how to catch and fix the bait - this was where my minnow trap skills came in – and finally where, when and how to deploy the lines for best success. I became good at catching eels and was proud to be following in a small way in the footsteps of a man who was a great self taught naturalist. Sadly when he died the coracle and stuffed birds were destroyed, but as the salmon and eels he so easily caught have drastically declined from their previous abundance, his going marked the end of several eras.

The whole area around Cae Howell served as a valve for the River Severn controlling the downstream flow of flood waters with hundreds of acres becoming temporary lakes often several times each winter. Come the water, come the birds, for no sooner had the floods arrived then, as if by magic waterbirds populated these shallow waterbodies. Mallards, widgeon and mute swans by the hundred swam over these water-filled meadows some often lake-like for several weeks at a time. As the river had done for several thousand years, it annually reinvigorated the pasture with nutrients by depositing fine alluvium from the light brown turbid waters. These wetlands were drained by slow flowing streams in parts straightened as part of the flood protection system which included embankments, locally known as argaes, built by none other than Thomas Telford the famous Civil Engineer while he was County Surveyor for Shropshire from 1787.

It was in these drainage streams, which were two to three metres wide, that I spent many hours fishing for chub, small pike and eels between the thick clumps of yellow water lily and other aquatics. Compared with the main river these were waterways rich in aquatic invertebrates and it was here I honed my basic

freshwater identification skills and remember my excitement having just studied hydra in my biology class at school to find the animals for the first time on the underside of water lily leaves.

Coarse fishing the main river meant sitting quietly on the bank so that wildlife was more likely to come to you than having to actively seek it out. It was the early 1950s, before its general decline, that I recall sitting on the river bank, waiting for my float to bob, when a high pitched watery whistle came in to earshot accompanying the bow wave of an approaching otter. Many years later, Ray, a teacher I worked with in Darlaston, who was a keen otter hunter, told me that the next weekend they were hunting the Vyrnwy a few miles from Cae Howell, so I joined them on a, fortunately unsuccessful, otter hunt, but felt that this occupation was not for me for, never mind the otters. Ray never let his hunting boots dry out, leaving them outside his back door to keep in best damp condition. That morning, all the huntsmen first crossed the river by wading chest deep in cold water, but, to me, wet boots and wet clothes on a day's walk seemed rather uninviting!

Although now scarce, in those days, if all was quiet, as I waited for a bite on my fishing line, it was common to hear water voles chewing the bankside vegetation on the opposite side of the river then plopping in to the water and swimming parallel to the bank to disappear in to a hole in a clump of vegetation. Sadly American mink and other pressures have pushed the water vole in many places to the brink of extinction – you can perhaps imagine my excitement when I discovered that these animals had a twenty-first century stronghold amongst the almost impenetrable purple moor-grass hummocks which coat the hills behind Newbridge and across to the Elan Valley.

Over the half a century during which I visited this part of the Severn, I think the biggest natural history change was the rise in the numbers of Canada geese. As a youngster, a then rare family group of these geese alighted on the river close to the Royal Hill Inn, flagging up the possibility of an off-ration Sunday dinner. Frank

Pugh the licensee and my dad and Maurice took their shotguns down to the river for a potential goose roast. They waited for one of the geese to put up its head then shot. This was a fundamental mistake as this vigilant goose was evidently the old gander and his ageing flesh tested our teeth to the limit! We never saw any more geese there for many years, but in the last couple of decades I have seen groups of at least three thousand Canada geese wintering in the residual flood waters on the Welsh side of the river opposite Cae Howell.

What must have made tough meat seem tougher to older family members was that most of the adults I knew in my youth had none of their own teeth. Many had a full set of false teeth bought as a 21st birthday present!

Frank at the Royal Hill gave me my first practical introduction to farming. He had a few cows which were milked by hand, mainly by his wife Millie, while he leaned over the half open stable door of the cowshed mopping his brow at the thought of the work Millie was doing on his behalf. He would get me to spend half a day cutting (dinging) thistles and pay me generously with a 6d (2.5p) bottle of lemonade. If I was around when a newly calved cow needed to be brought in with her calf, a time when the cow is most protective and potentially dangerous, he would send me when I was probably 8 – 10 years old to get her, giving instructions from a safe distance. I also got to collect eggs from the chicken shed which in a strange way I've always found a satisfying activity – probably linked to ancient hunter gather instincts. It was also Frank who taught me how to kill a chicken by “necking” it – far better than my childhood pal Clive's mother, who lived next door to the Royal Hill in Griff Phillips old bungalow, who couldn't face necking them, so chopped off their heads – I rapidly became very aware of what was meant by the phrase “running around like a headless chicken”!

Clive and myself spent a lot of time exploring the countryside, looking for birds' nests, fishing and trying to discourage the use of their bungalow eaves as a nesting place by the many starlings who habitually nested there, so many in fact, that Clive was tasked with removing the eggs on an almost weekly basis

collecting fifty plus eggs on each round at the height of the breeding season. It is not Clive's fault (!) but I have not seen a starling's nest in mid Wales for twenty or more years where previously, here at Newbridge-on-Wye, five nest boxes on one building were always occupied and were always the first nestlings of the year which I ringed, I now think of them almost exclusively as a winter migrant roosting in vast flocks in the hinterland of Llandrindod. When my children were young, the village Turbary at Aberithon, aka The Bog, annually hosted a roost of many tens of thousands of starlings and the sight and air slicing sound of vast numbers of birds flying in just metres above one's head was an exciting event that every child should experience.

Back by the Severn, Clive lived close to Cae Howell so was a regular helper there. The farm was occupied by Mr. and Mrs. George Davies, whose memories went back to the First World War when George was a cavalry man using his equestrian skills developed in the Welsh hills and his wife would then walk almost ten miles to and from market to sell a heavy basket of butter. Their sons were George, who married Edith, a sister of Millie Pugh from the Royal Hill, and he ran her family farm called Ashlands, John who remained unmarried and lived at Cae Howell with his brother Ted who married Ruth and had six children, Glyn who became a mechanical engineer, Martin who became an electrical engineer, Edwin, George and Trevor who remained in farming and their sister Joy.

Before Ted's family grew up was the time when I mainly (generally during holidays) helped out on the farm. I first helped with the hay harvest when they still used Shire horses, when the loose hay was pitched on to the cart in pre-bale days and the field or two of oats, grown to provide food for the horses, gave me practice in making stooks of corn. Soon the little grey Ferguson tractor replaced horse power and a baler made pitching hay a lot more efficient. There were so many jobs associated with handling the hay harvest, from pitching and stacking bales on to the trailer, unloading in to the barn and finally stacking them for winter within the barn. A regular evening activity with Ted and John during harvest was

the Evosticking of patches, often on layers of previous patches, on the knees of our trousers, victims of knee-bouncing bales when loading the lower levels of the trailers. All these were quite energy sapping activities, no wonder there was always food on Mrs. Davies' table, starting at 05.30 with a snack before milking; 08.30 breakfast; 11.00 mid morning break; 13.00 lunch; 16.30 pre-milking tea and cakes; 19.00 supper – and no one was fat! For the thirsty work of harvest there were always bottles of cider kept cool under the hedge to re-hydrate the workers. Another physical activity which disappeared in my early years of farm work, but one which I was also able to do, was reseeding of fields using a fiddle, bowed with precision like a violin, not in musical mode but in the tempo of bowing and walking and the line you followed across the field, and a big field is an awful long way to walk in narrow strips! But in time with the advent of tractor technology, much of the physical side of farming was lost, no more spending days pitching bales, cutting miles of hedge by hand or “dinging” thistles with a “brushing hook”, using a shovel to shift muck or a spade to clear ditches as these became the calorie burners of the past.

However, shearing sheep, nose ringing and castrating pigs, “drenching” uncooperative young Aberdeen Angus cattle, rounding up stock with fur or feathers or even bringing in the cows for milking certainly meant that not all physical energy requiring activities disappeared. From helping with the births of lambs and calves and watching the vet operating on livestock, milking cows by hand sitting on a three legged stool, to watching the conversion of a live pig to bacon joints, the farm proved a place full of new and, to me, formative experiences. Our caravan at Cae Howel was almost a second home and we continued to visit and holiday there until our daughters were in their early teens and I had known the place for half a century.

In retrospect, one thing that struck me was the difference in these early post war years between town and country and probably throughout the previous war years had I known the area then. Although both town and country suffered the loss of

friends, neighbours and loved ones to the war, day to day life in the Blackcountry was moulded by the wartime austerity and rationing which ruled most of our lives, whereas in the country it seemed as if life had changed very little, as farmers, by their very nature grew food, and in those days almost all farms were mixed so there were no shortages of milk, cream, butter, eggs, chicken, vegetables, and flitches of bacon always hung in Cae Howell's pantry as they were regularly produced on the farm. In this somewhat idyllic landscape, which ignited my love of quiet countryside, where you could walk all day and see almost no-one, it is perhaps ironic that less than four miles to the west at Criggion, tucked under the shelter of Breidden Hill, were a series of tall radio masts which for security, the older war time editions of my Ordnance Survey maps fail to show.

These were the key to long wave transmissions to navy vessels around the world and as such, if the Cold War had ever become "hot", would have been one of the first places in the UK to suffer a nuclear attack in order to destroy our military communications capability. Fortunately, the masts are gone, and their use nearly forgotten. However Breidden Hill, topped with a column to Admiral Rodney and scarred by decades of quarrying of its igneous rock as road stone, gave me a botanical connection to my later life by the Wye. I knew of this hill then for its botanical rarities such as rock cinquefoil, which only occurred in Wales here and by the Wye south of Newbridge, as well as sticky catchfly, spiked speedwell and other plants I later came to know and study at another rare plant hot spot on the Radnorshire – English border at Stanner Rocks.

The Wye

Liz and I arrived at Llysdinam in September 1974 originally thinking, when applying for the post that the university was taking over Llysdinam Hall with its commanding view over the Wye Valley; it's almost incomparable collection of Nantgarw china and wood panelling and library from the family's former home at Penllergaer near Swansea. But we were soon made to realise that the Llysdinam Field Centre was to be above a couple of old garages in the backyard of the

house, plus a few prefabricated buildings out of earshot of Sir Michael, then Lord Lieutenant of Radnorshire, and his wife Lady Delia Dillwyn Venables Llewellyn, our landlords. Sir Michael, (The Brigadier) inherited the title from his father Sir Charles who will reappear later in my story.

The reason there was a post available at the Field Centre stemmed from the fact that Sir Charles and his wife died within a few years of each other and this resulted in double death duties and the selling off of the periphery of the estate to pay them. To prevent the core of the Llysdinam estate being eroded by death duties in the future, this core, including the gardens and surrounding land were placed in to an educational trust and facilities offered to the various constituent colleges of the then University of Wales and it was the then University of Wales Institute of Science & Technology in Cardiff (UWIST) who took up the offer and in 1970 opened an unstaffed field centre on site. Professor Ron Edwards, the then Head of the Department of Applied Biology at UWIST, later secured a large contract to study the implications of the enlargement of the Craig Goch reservoir in the Elan Valley into the biggest area of man-made open water in Western Europe. This contract with its six research staff was to be based in new offices at the Field Centre and someone was needed to manage the facility and that was me!

We arrived in the September of 1974, Liz was commuting some 90 miles each day to continue her job in the Microbiology Department at UCW Aberystwyth, I spent the first few months operating out of the ground floor of the old coachman's flat in the estate's garage block. Here, over a period of two months, I caught over one hundred mice (mainly yellow necked) using two traps in a cupboard in my office, suggesting I was in a place with an abundant mammalian fauna! We lived in an estate house some half a mile away called Llethyr. After a winter in cold accommodation, but with stunning views towards the Brecon Beacons and the Mynydd Eppynt down the often fog-filled, Wye Valley, our flat, a small dormitory and offices for the Craig Goch group were ready in the spring of 1975. The

accommodation was not luxurious consisting of a wooden prefabricated block which Wernicks usually constructed as site offices with an expected life of eighteen months. As I write these same buildings are still in use some forty years after construction, although the prognosis on their life expectancy is rapidly getting shorter!

These were the days when back to nature hippies lived in considerable numbers all over mid-Wales, frequently in “benders”, large tepee-like tents made from a framework of long, thin woodland poles. They believed in “flower power”, free love and living within the smallest possible environmental footprint. This usually meant horses and traps rather than cars, no electricity, running water or conventional sanitation and, not infrequently, outbreaks of jaundice in local schools could be traced back to these unhygienic conditions. In some summers they moved in to the Elan Valley beside the river feeding the reservoirs supplying Birmingham with water, but after a week or two legal processes moved them on. As I often commuted to my old cottage near Aberystwyth via the mountain road from Rhayader to Cwmystwyth, the largely naked revellers added some transient diversity to this land of hills, bogs and sheep. Ageing blue-rinsed ladies would sit in their cars on the road above the encampment and use their binoculars to confirm their disgust at the acres of naked flesh. On one occasion I stopped at the then village shop in Cwmystwyth and outside was a pony and trap and inside the shop was its owner, a tall, bearded, tanned and almost naked man save for a triangularly folded men’s handkerchief strategically hanging from a piece of white string around his waist. As he left the shop to join his dreadlocked friends, the lady behind the counter said “Thank God you came in bach, I didn’t know where to look!” These were usually happy hippies, as, not infrequently about this time, I came across woodland glades, well off the beaten track, with fine growths of cannabis and on one occasion a local farmer confiscated a large bag of toadstools from hippies on his land and left them hanging on my front door for me to identify. When he telephoned me later it was my turn to say “Thank God...” but

this time the sentence ended “.....that I wasn't visited by the police as you left 1kg of a Class A drug on my front door – namely “Magic Mushrooms!””

After some five years in the Field Centre flat, where our bedroom was separated from the students dormitory by a too thin wall, we bought Bridgehill, a eighteenth century stone house adjacent to the Wye Bridge, previously occupied by Mr. & Mrs. Baker, the former gamekeeper on the nearby Doldowlod Estate and his wife. The house had one inside cold tap, an outside flush toilet (which we were told Mr. Baker objected to when there was (previously) a perfectly good long drop toilet behind the house) and electricity, but only on the ground floor. As you can guess we made some changes and eventually brought up our two children Claire and Helen there; after my mother died my Uncle Maurice came from the Midlands to live in a flat converted from the wooden barn/goat house which adjoined the main house; we also shared our home with four dogs – one at a time – several cats, rabbits, tortoises, an axolotl and assorted other pets.

My new job was a bit of everything, I did the day to day management of the Centre; I taught both in Cardiff and on field courses for our own and visiting groups; I ran evening classes for Coleg Powys in Llandrindod and University of Birmingham Extra Mural Department in Kington (as it was just within Birmingham University's English catchment) and gave many talks to outside organisations, over 30 per year for the first few years, mainly to raise the profile of the facility. I supervised postgraduate research and in 1976 became involved in the work of the Royal Welsh Show, the latter mainly because Sir Michael Venable Llewellyn was that year's President of the Show and wanted an exhibit from the Llysdyham Estate which we were asked to provide. Partly again, because Sir Michael was Trust President, it was at about this time that I was invited on to the Radnorshire Committee of the Herefordshire & Radnorshire Nature Trust (HRNT), which later became the Radnorshire Wildlife Trust. At first, the sole remit of the committee was to meet twice a year, discuss issues arising in the area but without much other output. I instigated a regular programme of wildlife talks with myself and

Ray Woods as the main stalwarts. Denys Smith, the then Chairman and Headmaster of Whitton School, stepped down when he retired to Carmarthenshire and I took his place. The government, through its then Manpower Services Commission, paid for unemployed young people to be gainfully employed for a year and therefore, for the next few years, in collaboration with the University, Powys County Council and sometimes the RSPB, up to twenty, mainly graduates, were taken on for a year's paid work experience. This enabled us to explore many aspects of natural history in the area such as wildlife road casualties, toad patrols, inventories of old meadows and woodlands, peatlands, ecological evaluations of the Wye, Severn and Teifi and importantly to run the Radnorshire Section of the joint Herefordshire & Radnorshire Nature Trust (HRNT) as if it were independent, raising its profile, attracting new members and working for the best interests of the county's wildlife. With the Field Centre to run and the Trust demanding my attention together with my role on the HRNT Board, Editorial Board of Nature in Wales, a journal which went to all members of Wildlife Trusts in Wales, and other associated committees such as the Association of Wildlife Trusts in Wales (now the Wildlife Trusts Wales) and the RSPB Committee for Wales, it was clear that the Radnorshire Section of the HRNT was now well established enough for me to step aside and concentrate on my paid job. It was time for the Trust to break with Herefordshire and become the fully independent Radnorshire Wildlife Trust. This was my job done, so at this point I stepped down from chairmanship and put it in the capable hands of Dr Gordon Parker.

The local people in Newbridge-on-Wye were very friendly but curious about what we were doing in the village. Ray Hope, the local village builder and undertaker said to me "I know what a farmer or publican does for a living but an ecologist?" Initially I think most farmers thought I was a little mad in what I did "He looks for frogs, you know" so they humoured me and let me wander where I wanted. Many of the outside organisations to which I spoke about local natural history were Women's Institutes and I was frequently invited to look at the pools/woods on

their farms with the comment “I will tell my husband you to expect you”. If the wife had spoken you knew you were OK.

We also got on well with the Venables Llewellyn family, although on occasions they felt the strain of having us in their backyard. During the summer holidays I took in some less conventional groups. On one occasion we had a children’s home from Leicester and I was called in to help chase after a lad with a knife who they believed was about to kill his twin brother, the knife was wrestled from him and is still probably at the bottom of the Field Centre pond. A Muslim group took over one room as a mosque which retained the name long after the group left but the only problem we had with them was that, after prayers at 4am, the lads wanted to play football and chose the flat parking area in front of Llysdinam House for that purpose which was understandably not appreciated by the family. Similarly when the then Ministry of Agriculture took over our labs to post-mortem rabbits and foxes and then boil the fox heads to clean the skulls, the family in the house made it clear they did not appreciate the smell – the Ministry had come to us as their labs in Llandrindod were below the staff dining room and the percolating smell had not enhanced the cuisine. The family at Llysdinam House had various dogs over the years but only one enjoyed communing with our students and then heading off home with items that had a bit of “body” such as worn socks or underclothes and this caused some embarrassment when students had to go and ask at the house for their items back! During a lake survey our surveyors returned with a several months old, addled Canada goose egg just to prove nesting at the site. The egg was left outside on a flower pot and forgotten until the lady of the house came to see us and said that their dog had taken this rotten egg into the house, then lay on their antique settee and proceeded to break the egg and roll in its contents on the said settee – lady of the house was not happy - it may have been our egg but it was their dog!

Just before I left Aberystwyth I led a Radio Nature Trail around Borth Bog and Ynyslas Dunes for the BBC Natural History Unit and afterwards they said they

liked my voice, others said they thought I had a good face for radio! I was then invited to join other naturalists on the panel of The Living World for the BBC Natural History Unit in Bristol broadcast on Radio 4. This continued as six or eight such programmes a year for around a decade. I did other natural history programmes for them, as well as for Radio Wales, and quite regularly for the BBC's World Service with BBC reporter Phil Rickman. The latter was quite fun, had a massive audience, but was only heard in the UK in the middle of the night. Early one morning I went to collect my paper from the village shop and met Miss Williams, a charming, ageing, spinster who ran the Llysdinam Estate Office, who congratulated on a most interesting programme. A little confused, as I had no UK programmes due to be broadcast, I asked when she heard this. "I got up to have a cup of tea at three o'clock this morning and there you were" You never know who hears the World Service!

At this time I also did some television not infrequently with Phil Rickman, and, together with some other BBC staff, we put together a pilot programme about the countryside and environment of Wales which was submitted to BBC Wales but it proved to be a bad time as the commissioning editors, unknown to us, were changing, and a potentially excellent series was lost. Soon afterwards Phil, who was BBC Wales Reporter of the Year on a number of occasions, became disillusioned with broadcasting and became a full time writer. We did not lose contact as, occasionally, I would get a phone call such as "How would you detect human fat in a candle?" or a technical point relating to peatlands and a few ideas I put to him turned up as key parts of storylines in his work. The good thing about this period was that, through broadcasting, I met almost all the eminent naturalists active at this time, a childhood ambition fulfilled. I am still surprised that this very shy child and rather anti-social adult should so enjoy performing to an audience and the bigger that audience the better!

After some five years, their contracts ended, most of the Craig Goch group left the Centre, with the group manager Mike Brooker later going on to be Chief

Executive of Welsh Water/Dwr Cymru. Other research groups and individuals came and went with the vagaries of short term funding and, with changes to teaching contracts in schools, the school field course market declined, but in funding terms, the rise of EU money more than compensated for these changes.

The Field Centre's relative stability over the years contrasted with the structure of our parent body in Cardiff which began under UWIST as the Department of Applied Biology which later merged with Applied Microbiology.

University College Cardiff (UCC), over the road from UWIST, got itself in to a financial mess and was effectively taken over by the solvent UWIST and I then came to belong to the Department of Pure & Applied Biology incorporating the existing UWIST Departments with, Botany, Zoology, Microbiology and Biochemistry from UCC with UWIST's Prof Ron Edwards still in charge. This Department continued to grow and moved to new buildings as the physiological sciences and anatomy from the "medical fringe" were added making it a "super Department" so large (larger than the whole of the then University College at Lampeter) that it eventually became the School of Biosciences. Following the merger in 2004 with the School of Medicine it became part of the College of Biomedical & Life Sciences in the new independent Cardiff University by which time the Nobel Prize winner Sir Martin Evans was in charge. Sir Martin, a totally approachable man, lacking the affectations which the highest accolades in science might instill, he would visit the main undergraduate field course at Llysdymanor in his modest camper van with his wife and well travelled cat.

After all these years there are inevitably anecdotes to slot in to failing conversations:

- After visiting some woodland on steep sea cliffs with a group of students, we discovered one spare seat when we returned to the minibus. The student was nowhere to be found, so we feared the worst, but after several hours' search he was discovered wandering along the cliff edge two miles away having "forgotten" the two field route back to the minibus.

- We also lost the same student the previous year in an area of limestone pavement. All, except (this) one student, returned to base on time. No one had seen him for hours, a long search found him fast asleep in the bottom of a deep gryke, or fissure between the limestone slabs.
- One evening I went to speak to a visiting university group, asking first if they were all present. “Yes” came the confident reply. “Then why is there a spare place at your dining table?” I asked. “Oh, *****! When did we last see Tom?” At the Dolaucothi Gold Mines an hour or so away by minibus, was the general consensus – it was dark by the time he was rescued.
- We parked a minibus by the roadside drainage ditch at Borth Bog, opened the sliding door and the first student dropped two metres in to the peaty water with just his head and shoulders visible. In spite of his protestations he was not rescued until all his “friends” had taken his photograph!
- My two Primary School aged daughters were sitting happily on the laboratory bench, with blooded gloves while “helping” me post mortem a badger. I had just removed and cut open the stomach and tipped out its contents into a sorting tray to their great delight, when in came a graduate student, he looked at the blood-soaked scene, turned green and rushed out to vomit. In his own eyes he never lived down the indignity of having a weaker stomach than either of my daughters, but it all depends what you have been used to!
- The house mouse in mid-Wales is often replaced by the yellow-necked mouse, a relatively large rodent with a taste for electrical cables and the metal of Longworth small mammal traps. We kept 50kg of peanuts in bags in one of our prefabricated buildings but over a few weeks virtually all disappeared. Needing to located an electricity fault (later identified as a mouse chewed cable) we removed a dual outlet electrical socket from the wall and out flowed almost all our store of peanuts
- Sabotaged field experiments happen not only to genetically modified crops.
- Secretaries do run off with milkmen.

- I once found a suicide whilst I was out mushrooming.
- I did employ one convicted and one probable murderer, but all part of the rich tapestry of life.

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After 40 years at Llys dinam it is inevitable that there have been many twists and turns in both my and the establishment's activities which are perhaps best told as separate stories.

2. Dabbling in the Water – Rivers, Crayfish, Amphibians & Ponds

Professionally, it was probably rivers which brought me to Llysdinam in 1974. Let me remind you of the background. In 1970 UWIST, a constituent college of the University of Wales as it then was took up the offer from the Llysdinam Trust to establish a Field Centre on the Trust's land on the Llysdinam Estate in mid-Wales. At first the Centre was a couple of laboratories above the old coach house, plus the equally old coachman's flat, supplemented by a new residential block, but the facilities were unstaffed. A contract to study the biological and associated implications of enlarging the Craig Goch reservoir in the Elan Valley to be made into one of the largest areas of man made open water in Western Europe, brought a new building to house the Craig Goch Research Group (CGRG) and myself initially as Field Centre Manager and later Director. The CGRG team consisted of five staff headed by Dr Mike Brooker. Their job was to investigate the probable and possible effects of this new reservoir on the fish, invertebrates and water chemistry of this water body on the rivers involved.

As a botanist by training, I was brought in to look at the botanical implications of this ambitious scheme. The project was planned to create a new dam almost two kilometres long in front of the existing Craig Goch dam, and a lake so big that another dam was needed some 8km away at the western end, to block off the outflow of the Ystwyth River through the Ystwyth gorge, diverting its clean water into the new lake. Loss of this clean water was a contentious problem as it would inevitably exacerbate the problems of heavy metal pollution further down the river Ystwyth as it drained a succession of long abandoned lead mines. To fill a lake of this size would need more than the combined waters of the impounded Elan and the diverted Ystwyth rivers. Over a seven year period it would gradually fill from these waters plus water pumped from the Wye and a tributary of the Severn. These reversible links to the Wye and Severn were key to the scheme which was designed to supply water as far away as London by so called, river transfer. If water was needed by, say, South Wales, it would be released into the Wye, from there transferred to an Usk tributary and pumped on to a Beacons reservoir. Similarly, the Severn tributary abstraction pipe would allow water in the other

direction to flow to and down the Severn, then to be pumped to a tributary of the Thames. Such proposals would alter the natural seasonal flows regimes in all the rivers; could possibly carry disease or parasites to fish in other rivers; could confuse returning salmon who find their natal river by its smell with unknown consequences to the genetics (not to mention the fisheries) of the river systems concerned and the reservoir itself would be large enough, because of its heat holding properties, to alter the local climate in the Elan/Rhayader area. When the original dams were built, at the turn of the twentieth century, all were served by railway connections, but today, such facilities do not exist and all sand and gravel for concrete would have to come by road from Cheshire, one lorry every few minutes for several years.

My allocated contribution to this scheme was, via my PhD student David Merry, to investigate if this new flow regime in the Wye would affect the aquatic vegetation and two rare riverside (riparian) plants of the mid-Wye, wild chives, with most of its British population along this section of river, and rock cinquefoil, at one of its two British locations outside northern Scotland. The commonest moss in the river, willow moss (*Fontinalis*) only reproduces in the summer in low flow conditions when it becomes only partly submerged, and this was also included in our study to determine the effects of a changed summer flow regime on its reproduction, as was a complete description of the aquatic and riparian vegetation along the entire length of the river. After many experiments growing these plants under controlled conditions we concluded that the additional flows down the river would not adversely affect any of these plants – not an exciting result, but that is how science works. Growing wild chives alongside cultivated chives showed how very different are the wild and cultivated forms, clearly the wild types were no garden escapes! Some say that wild chives were the original Welsh “leek” emblem; it certainly has an attractive flower and could be worn more easily than a leek!

The CGRG produced over fifty reports most of which were subsequently published in scientific journals, but after the Group left we carried on with river research via PhDs looking at salmonids (salmon and trout), river algae and river invertebrates. In collaboration with the RSPB, Powys County Council, Welsh Water, Powys County Council and the Manpower Services Commission (MSC) I managed a two year project designed to develop protocols to objectively describe riverine systems using information from the Wye, Usk and Teifi. Tightly integrated teams described the birds, otters, fish, invertebrates, higher and lower plants, habitat features and water chemistry. The methodologies developed have since made contributions to nationally and internationally accepted regimes for surveying river habitat via the River Habitat Survey (RHS) plus other survey techniques with acronyms such as SERCO and RIVPACS.

In those days Health & Safety Regulations and Risk Assessments were not as rigorous as they are today and one of my four man MSC survey teams came over from Tregaron via the Cwmystwyth mountain road to Rhayader for our fortnightly meeting at Llysdinam. After the meeting and saying “see you in two weeks” they headed back along the same route initially through a light snow shower at Newbridge and I moved on to my next job. What I and they didn't know was that on the mountain road they would run in to a full scale snow storm. So bad was it that they had to abandon the car near the Ystwyth/Elan watershed and head back on foot to Rhayader across the open uplands, through heavy and deep snow. Some twelve hours later they arrived in Rhayader. That night in Newbridge we recorded our lowest ever temperature of -28°C equal to the record coldest temperature ever formally recorded by the Met Office. Our record of -28°C was at our own weather station at some 150m above sea level, so what temperature it would have been at 400m on an open mountain one can only imagine. The car was recovered when the road reopened some weeks later. Certainly makes you appreciate the occasional value of modern mobile phone technology, as these lads had no mobile phones, were miles from the nearest

habitation, and so had no way then of raising the alarm should they have needed rescue.

The government's Manpower Services Job Creation Scheme put many graduates on the first rung of the ladder to professional success. The scheme did however educate me in the ways of government, valuable lessons for later life. On one occasion an unemployed graduate contacted me about a vacancy on the MSC scheme and as she had been out of work for more than six months I told her that, provided MSC cleared her application, the job was hers. Rather than become a couch potato during her unemployment she took the then Prime Minister's advice and helped unpaid at a charity although they paid her bus fare to and from work. I got my reply from MSC who said no! In their eyes she had been paid (bus fares) during her voluntary work so did not qualify. The girl rang me asking if I would object if she took the matter to her MP and I replied that I would encourage her to do that. The MP got no joy from MSC so he tabled a question in the House of Commons. Two days before the question was to be answered in parliament, in true James Bond style, I received an "anonymous" phone call from MSC, telling me "this call has never taken place" but, if I did not fill the vacancy before the answer was given on the floor of the House, both of my then MSC projects would be immediately shut down putting over twenty people out of work. I subsequently spoke with the girl who, in view of her treatment by MSC, said she would not be comfortable taking the job even if offered and I should go ahead and fill the vacancy. The question came before the House and the Minister explained that on reflection they would be prepared to make an exception and allow her to take the job but sadly the vacancy had subsequently been filled! After that nothing has surprised me about the workings of government.

During the CGRG days Andy Lilley did the first survey of native white-clawed crayfish in the Wye catchment and interest in the species subsequently increased as crayfish plague, a fungal disease totally fatal to native crayfish, was

brought to Britain by importations of the American signal crayfish. John Foster joined me in the early 1980s to undertake his PhD on native crayfish in mid-Wales, to plot where they were; assess the stocks; what were their habitat requirements; could they, if need be, be bred for restocking after plague and what was the feasibility of introducing them to largely non-acidic rivers hopefully out of the reach of signals. At this time most of the Wye tributaries between Builth Road and Hay on Wye were abundantly stocked with native crayfish, in some of our streams we found a biomass of crayfish of up to 90g/m². For restocking purposes John and I would catch crayfish knowing that we could relatively easily collect 100 per hour between us, without seemingly depleting the stock.

When Mererid Howells joined me to carry out her PhD studies on crayfish a decade or so later, on one of these streams, the Edw, where we once found such high numbers, we now found just five crayfish in twenty-five man hours of searching and now no native crayfish are found in the river. John published papers on the habitat requirements of native crayfish and found it possible to breed the species in the lab and he also released crayfish in rivers and reservoirs from Solva in Pembrokeshire, the Neath and Taff Valleys, to more local sites such as at Howey near Llandrindod. Although the then Nature Conservancy Council approved this work, the species had yet to gain the protection of the Wildlife & Countryside Act, so was not subject to legal controls.

We followed the outcome of these introductions, resurveying after one, two, five, and nine years but in spite of up to several hundred animals going in to each site, we subsequently found none. Had the experiment failed? A belated report of a single individual from Solva filtered through to us after about five years, then silence. After some fifteen years we received reports of native crayfish being caught in one of the Taff reservoirs (Llwyn-on), not in the feeder stream where we introduced them, but in the lake itself. About the same time we got reports of some being caught for “a few years” in the brook at Howey. This is clearly a case of patience being a virtue. Ironically only a few years after they were first found in

Llwyn-on, photographs were published of goosanders clearly eating signal crayfish which they had caught in the reservoir – the invaders had arrived and natives are no longer recorded. Mererid reassessed the state of native crayfish populations in mid-Wales and the border counties as well as carrying out genetic studies to determine the origins and relationships of remaining populations. From abundance in almost every suitable mid-Wye stream in the 1980s they were now reduced to just a few streams being abundant only in the Nant yr Offeiriad perhaps significantly where it leaves the Mynydd Eppynt military ranges, so relatively unaffected by agricultural disturbance and chemicals. However, significant populations were still present over the border on some Monnow tributaries, with a few on a second order tributary of the Severn.

After a classic case of crayfish plague on a Wye tributary near Glasbury in the early 1990s few other confirmed cases of the disease were subsequently reported in Wales, but the native crayfish population continued to decline. Siltation and eutrophication of rivers, due largely to European Union financial incentives for agricultural intensification, were at least partly to blame, but the use of synthetic pyrethroid chemicals in sheep dip, replacing the previously used organophosphates dips which were highly damaging to human health, caused total devastation of invertebrate life in rivers when dip spilled in or even dripped in off a recently dipped sheep, such were their toxicity even in minute concentrations. Subsequently controls on sheep dip and its disposal were strengthened.

Travelling on a Welsh Government grant with Mererid to study crayfish in Australia where they are commercially important, we first stopped off en route in North Island New Zealand in an area where they have just one of the country's two native crayfish species *Paranephrops planifrons*, similar to ours in size and habitat preference. The pastoral sheeplands of North Island look very similar to mid-Wales and suffer the same problems in their streams of siltation and

agrochemicals putting their crayfish in these areas under stress and they, like us, are doing all they can to limit invasion by non-native crayfish.

Australia is well endowed with native freshwater crayfish species with some 150 species spread over its five states ranging in size in mainland Australia from the ornate, lobster sized *Euastacus* species to the tiny subterranean *Gramastacus*. The medium sized yabby (*Cherax destructor*) and red claw (*Cherax quadricarinatus*) are the two main species of commerce both wild caught and commercially reared.

Travelling via Northern Tasmania we saw the Tasmanian giant freshwater crayfish *Astacopsis gouldi*, the largest in the world and in the past reaching over 5kg, but now rarely found at over 2kg, again a species shown to be at threat from pollution, and habitat destruction and persecution by man and is classified as endangered on the IUCN Red List.

The toxicity of synthetic pyrethroids, especially cypermethrin, was demonstrated to us at a red claw crayfish rearing unit in Queensland, where the creatures are grown in one acre ponds and each pond netted of crayfish at each harvest, with any escapees being chemically killed off, to allow synchronous growth, and this is achieved by introducing half a teaspoonful of cypermethrin to the one acre pond for total clearance within three or four days. Easy to see how a dripping dipped sheep standing in a small stream in Wales could cause such invertebrate destruction.

Visiting Louisiana with John Foster in 1990 was a serious experience for the dedicated crayfish man. The United States are the home to 350 of the world's 500 or so species of crayfish, but only a few are of commercial value. The American signal crayfish, known there as the Columbia River signal crayfish, found in western Canada and the northern states of the US is one, but the red swamp crayfish (*Procambarus clarkii*) from the southern states is of greatest

economic interest with some 50,000 tons produced in the US each year mainly from Louisiana for the domestic market. A crayfish boil, where each participant may get a plastic bucketful of boiled crayfish (here called crawfish) with a few added potatoes, onions and corn on the cob, is a clear indication of the abundance of the species, especially if experienced at a large event such as a 400 person crayfish conference dinner!. To get the real flavour of Louisiana you need to visit one of Mulate's Cajun Restaurants, listen to live Chank a Chank music and eat jambalaya, gumbo or a mixed grill of Atchafalaya frogs' legs, catfish steak, alligator steak and fried crawfish. Today, *P. clarkii* has spread worldwide, and most crayfish tails imported into Europe now come from the several hundred thousand tonnes of *P. clarkii* crayfish tail meat exported from China each year. This has undoubtedly adversely impacted the lives of the poorer people of the state of Louisiana who earned a meager living by peeling and packing crayfish.

When I was there a newer product was entering the market, soft shelled crayfish, which were newly moulted individuals, which can be eaten shell and all and are quick frozen for the export trade. This involved large buildings full of shallow trays each tray containing hundreds of crayfish, with a constant patrol of people checking each tray about once an hour for animals in moult.

For the general market, crayfish in Louisiana are produced in artificial ponds. The dry pond is seeded with rice then flooded, aestivating, egg carrying females, then emerge from their tunnels, their eggs hatch, and within about three months the pond is ready for harvest, far faster than the two years it takes for our native species to reach maturity. Some are harvested wild from the swamps of the Atchafalaya Basin, which at 5,700km² is the largest swamp area in the USA. In this area these largely detritivores, are the base of the food chain and feed many of the creatures of the swamp from birds and snakes to the eel-like, aggressive amphibian, the amphiuma.

Perhaps a sign of the times, but the most recent PhD student who I have helped to supervise whilst studying crayfish, has been Jo James who has concentrated her research on invasive American signal crayfish in Wales, plus some of the other crayfish species more recently arrived in the UK, their distribution, interactions, plague infectivity and the role of small worm-like commensals (branchiobdellids) living on the shell or gills of the crayfish.

When I arrived at the Louisiana State University in Baton Rouge for the crayfish conference, I did not have politics on my mind and was unaware of a national Greyhound Bus drivers strike. I decided to travel from Baton Rouge to New Orleans by Greyhound Bus along many elevated road sections above the swamplands. At 06.30 the bus left the Baton Rouge bus station and turned left for New Orleans. "That's a relief" said the person in the next seat. "Why?" I asked. "It was at this spot yesterday, on this same bus that the driver was shot dead as a scab". This was America and the weekend before I left home there were fourteen separate murders reported from New Orleans in the British press, but this was a little close to home. The drive past petrochemical works, old mansions and on across the swamplands was uneventful, but as we entered the bus station in New Orleans, a mob of some fifty men ran at the bus and started to rock it to the point I thought it would flip on its side. Police came and moved the protesters back and I left the bus knowing a little more about the industrial politics of Louisiana.

In Mexico, also at another conference of the International Association of Astacology (i.e. the study of crayfish), my only near death experience on this occasion was a taxi ride to the airport in Querétaro – through the city at high speed, on the wrong side of the road, partly travelling the wrong way along a bus lane with oncoming busses – but, I clearly survived. This is an interesting area for crayfish, where new species are still being discovered. My host had tanks of two species both unnamed and new to science, and he believed more were still to be found and this just a few hours drive south of the US border. In this part of

Mexico crayfish have long been an important protein source for local people who often consume them in a soup-like stew and I am told, bags of small specimens were eaten in their unshelled dried state in cinemas – the bags of “popcorn” of central Mexico.

Northern continental Europe has a history, documented over many hundreds of years, of eating freshwater crayfish with noble crayfish the most commonly consumed. Even today in Scandinavia, crayfish parties are part of the social scene where crayfish are consumed accompanied by just bread and spirits, so that conviviality is guaranteed and, as I observed after such a party, a subsequent late night coach trip along twisty country lanes necessitated the use of many black polythene refuse sacks plus numerous vomit stops! The noble crayfish has suffered, like our native species and its central European cousin the stone crayfish, from crayfish plague carried by the introduced American signal crayfish and in Scandinavian lakes by acidification due to atmospheric pollution. It is probably not just signals to blame as plague carriers, as at least ten alien crayfish species have been recorded in the wild in Europe, most potential plague carriers – only some 500 more species to go!

Across the world in Japan I was impressed by the country and its people. I was impressed with their trains, their punctuality, and the genuine politeness of their staff and indeed the nation as a whole. Tokyo, is a frenetic city but relatively easy to navigate because of the widespread use as, in most Japanese cities, of signs and public announcements in English. Tokyo’s main fish market is, in scale, and sheer variety of content, unlike anything I am likely to see elsewhere. In Sapporo, on the northern island of Hokkaido their “Octoberfest” closed each evening with the playing of Auld Lang Syne, incongruous but strangely comforting so far from home. But, to the crayfish aficionado, the streams around Sapporo in southern Hokkaido, with their populations of Japan’s single native species *Cambaroides japonicus* was worth the trip to see in spite of the fact that they are threatened by much the same factors as elsewhere in the world including the problems brought

by American signal and red swamp crayfish, plus habitat loss and pollution. There have been reports of crayfish as big as the Tasmanian *Astacopsis* being caught in Lake Mashu in northern Hokkaido but the species' identity and origins remain a mystery.

In Britain, amphibians more associated with still waters than rivers, although we have studied toads breeding in braided channels alongside the Wye, some species elsewhere do specialize in flowing waters. While in Japan I took the opportunity to see captive specimens in Tokyo Zoo of the Japanese giant salamander which can grow to 1.5m in length but now recorded as "near threatened" by IUCN, but I felt rather disappointed that I had missed out on a research visit to Hiroshima just prior to my visit to Japan where the species is being studied in the wild. A similar giant species from China, now on display in some British aquaria, has interbred with the Japanese species in the wild, and is causing concern in Japan.

Many of the long, thin, lungless salamanders of Europe are stream specialists being able, by their shape, to access stream crevices and being lungless it reduces their buoyancy helping mobility in flowing water. In Wales we did monitor a population of the totally aquatic, plump but toothless and tongueless African clawed frog which can be at home in rivers or ponds. This population probably resulted from animals released from laboratories when toads were no longer used for pregnancy testing. After several decades, however, this population seems to have disappeared. However, most of our work on amphibians over almost 40 years has been in relation to our native common toad, common frog and three newt species.

In 1978 we began a Manpower Services Commission project jointly with Powys County Council on wildlife road casualties. As I worked closely with the local Nature Trust, I became aware that one man, Mr. Doug Barnes (Barney), was single-handedly patrolling Llandrindod Wells Lake during the common toad

migration season, removing animals from the road which surrounds three sides of the Lake, to the safety of the water. As I had the staff, Andrew Parker and Paul Gittins, and these toads were potential road casualties, we joined with Barny and any members of the Naturalists' Trust who wanted to help and began what became a famous study. At the time, the scientific literature about toads was quite limited, so we took the opportunity to learn all we could about their patterns of movement and what controlled it; male female ratios; age range; year on year return rates, toadlet emergence and other related factors. The local newspaper quickly picked up on this toad lift and it soon became national, even international, news. Within a day or so of hitting the local press, three separate television film crews arrived simultaneously, together with numerous newspaper reporters and photographers (my wife and I were shown with toads on page 13 of The Sun!) and we did a total of thirteen radio interviews, including one for New Zealand, within another couple of days. After the first year we found that people were coming on coach holidays which stopped in Llandrindod, simply to see the migrating toads and a number of wildlife programmes came to film over succeeding years, on a cold night one crew even put toads into tepid water to keep them moving for the cameras!

But the science was just as novel as the publicity. Individually marking the animals with Alcian Blue dye using a Panjet, which shoots marking fluids through the skin harmlessly without needles, we found some 5700 male and 1950 female toads were coming to the Lake to breed during March and April, reportedly at that time to be more than the total toad population of Cambridgeshire. This 3:1 sex ratio may, in part, be due to males maturing and coming to breed a year, or even two, before the females, who themselves may not breed every year. We obtained these ages by sectioning the leg bones of road casualty animals to look for the tree-like annual growth rings. How many immature or non breeding toads remained in the vicinity we could not determine, but purely from the catchment area and the numbers caught we estimated that there were 23 breeding toads per hectare giving a biomass of living toad of 560g/ha^{-1} more than any

comparably sized small mammal, therefore a considerable potential food source in the food chain. Males, particularly small individuals, arrived at the Lake first, followed by larger males then the females. For the years in which we studied the population the first movement would be on the first night after day 65 of the year when the evening air temperature exceeded 5°C and, regardless of the weather pattern of the season, the breeding migration was over by 25 April. An exception to this pattern occurred after a very mild winter in the 1980s when many male toads were on the move in mid February. All were very light for their size suggesting the warm winter had caused them to use up their fat reserves, starvation forcing them to move, but whether they were to breed successfully we do not know, but we saw no females exhibiting this early movement.

Many males would remain for the whole of the breeding season, moving from the water to the road to wait for females every evening. There they would sit in a very upright posture showing off their pale bellies, in a prime location to have a good view of the road to detect approaching females but evolution had not yet taught them of the dangers of approaching cars to animals on the carriageway! In contrast females went straight across the road to the water, remained only a few days in the Lake then returned back to the surrounding woods. By mark and release we found toads moving at least 1km to the Lake which took them an average of seven active nights to reach the water. From several years of marked toad data it was found that on average 60% of the toads only came to breed on one occasion, although bone sections showed that some of the oldest females were up to nine years old,

To maintain this amphibian research programme beyond our Lake studies, we began to follow the frogs, toads and newts using the pond at Llysdinam Field Centre, mainly by putting a barrier around it with pitfall traps either side which we monitored every day. At that time there were about 1000 toads coming to breed in the pond each year, but, within a decade, for various reasons unrelated to the barrier, this had dropped to less than twenty, but, and this is the undoubted value

of long term studies, after almost three decades numbers recovered to around 300 and still seem to be increasing. What seemed like a disaster over a few years appears as part of a long term cycle when viewed in the longer term, a lesson for the typical three year study programme.

In the early 1980s John Harrison began a PhD study of the newts at Llysdinam pond. He recorded the arrival and departure from the pond of smooth and palmate newts over a three year period using the 16 pairs of pitfalls traps situated either side the enclosing barrier. In total over 1100 newts were recorded entering the pond in the first year, 800 palmate and 300 smooth newts. For every one male palmate there were 1.3 females and for smooth newts 1.2 females for every male in contrast to the high male to female ratios found for toads particularly at Llandrindod Lake. The 100 – 200 frogs coming to the pond had a 1:1 sex ratio. Biologically all populations should start with a 1:1 sex ratio so it is external factors which skew them in various ways.

In both newt species males arrived at the pond, depending on the year, 10 – 30 days before the females. In general terms, adult newts arrived in February and March and left May to June, giving average residence times in the pond of 105 days for female palmates, 101 days for male palmates, 100 days for male smooths and 97 days for female smooths. Movement patterns were correlated more with temperature than rainfall. Efts, the young of the year, generally left from mid May to early October with some overwintering. The number of newts caught leaving the pond was much lower than caught entering, with fewer females leaving than males, suggesting a high female mortality during the breeding season, a small proportion of which was probably due to a one time resident kingfisher although newts in pitfall traps were occasionally predated by pheasants or eviscerated by shrews . The partitioning of food by the four species was also investigated. Because of their tongue arrangement frogs and toads need to feed on land and, newts will extract and eat the embryos from frog spawn amongst their other food once they reach the pond. From gut analysis it

was found that our frog tadpoles fed largely on detritus on the bottom of the pond whereas toad tadpoles fed largely mid-water on living plankton and efts were generalists.

After handling, we estimate, some 10,000 newts, Richard Griffiths found a rather odd individual with the tail filament and black hind feet of a male palmate and the large black belly spots of a male smooth newt, the first wild caught hybrid between these two species to be found in Britain. Some twenty years later we found a second similar hybrid after handling many more thousands of individuals – Oh the joys of newting!

Over the next couple of decades PhD students Liz Chadwick, Emma Durward and Kerry Murton continued the amphibian theme, Emma looked at frogs and Liz and Kerry went back to the pond and its barrier to see how things had changed from Harrison's day. In spite of a global decline in amphibians, Emma's work found that the common frog populations of mid-Wales were thriving but Liz and Kerry's work showed a possible link with climate change with the increasingly earlier arrivals of breeding newts as years went by, and in general, the smaller the newt, the bigger the change towards an earlier arrival, with male palmates arriving up to two weeks earlier at the turn of the century than in the 1980s.

In the early 1990s a new species appeared in the pond for the first time and this was a female great crested newt (GCN), introduced we suspect by over enthusiastic students depositing sorted pond samples from elsewhere into Llysdinam pond. As each GCN has a unique belly pattern we put her on the photocopier to record the pattern and so individually identify her and found this lone female, who was full grown when first caught in the pond, returned for a further eight years. No more GCNs were found in the pond for several years until again our suspicions turned to inadvertent introductions by students when six immatures were collect going out from the pond suggesting a small breeding population. Over time the population had grown to a possible 100 or so by the 2010s giving us the opportunity to study their pattern of colonisation of the pond.

GCNs tend to arrive slightly later than the two smaller newts and, weather permitting, leave as late as early November. All three species have, in addition to the usual summer emergence, overwintering efts or young of the year, which emerge the following spring. Because we had polythene barriers with pitfall traps installed in lines throughout the coniferous woodland bordering one side of the pond, we were able to partially track the paths taken by them on their migrations to and from the pond. Several GCNs in successive years crossed the woodland within a metre or so of the route they had taken the previous year and even entered the same pond side pitfall trap on each occasion. How far they moved away from the pond we were not able to determine but we are aware of an individual found in a swimming pool on the eastern side of the Wye which must have travelled well over 1km from the nearest GCN breeding pond.

Some observations occur purely by chance. We were always puzzled by the number of frogs entering the pond to breed, as we had only tens entering the pitfalls but sometimes several hundred breeding. We thought they may have entered and left via an inflow ditch which was not securely barriered, but when the pond was drained and desilted, the dumper truck full of wet mud vibrated and bounced so much that the thixotropic nature of the mud turned it to liquid and up to the surface swam previously hibernating frogs from the bottom of the pond and our question was answered.

It was while surveying a stream for crayfish in winter that I was able to confirm that some frogs around here do hibernate under stones in small streams. On another occasion we were called to a building site in late summer because they had a problem. Thousands of toadlets had emerged from a nearby pond and fell into the effectively elongated pitfall traps which were the footings of the building. We took the opportunity to collect and rear on the toadlets over winter and into the following spring. What surprised us was that although most of these 1cm long creatures survived, only about 1% grew during this period despite all being fed, and this 1% became twice the size of their compatriots with none intermediate in

size. Was this a strategy of safety in numbers, providing so many individuals that the chances of any individual surviving predation was increased without wasting resources on food for growth of the vast majority?

During an amphibian survey of Cardiff we had had some newspaper and television publicity about the distribution some strange coloured frogs, some white, some yellow some red, and subsequently received a phone call from a man in the Valleys reporting a white frog in his pond and could someone go down and see it. Ben, who had collected the toadlets from the building foundations, went off to see this oddity. The house was one in a long terrace backing on to a steeply sloping valley side, a typical valleys' house. Like many other householders the owner had extended the garden on to the previously open hill land above his fenceline where he had built an ornamental pond. With great excitement the owner took Ben up the super-steep hillside towards the pond at the top. Nearly at the top the man fell, breaking his leg. Ben felt embarrassed and somewhat guilty about the accident and did what he could until the ambulance arrived. But, the pond owner and casualty, instead of expressing regret at the incident said, as he was carried away on the stretcher, "sorry to have brought you all the way here without seeing the frog – you must come back in six weeks when the plaster will be off and I will take you up again!" – Ben did not return!

After finishing her PhD on amphibians Liz Chadwick succeeded Adeline Bradshaw as the Research Fellow in charge of the Cardiff Otter Project based originally at Llysdimam but now in the School of Biosciences in Cardiff. In the 1970s, when it was discovered that I had a "dirty" deepfreeze at the Centre for anything "dead and interesting", I was requested to store any road casualty otters from Welsh roads prior to being shipped off to England for post mortem analysis. In those early days, Wales produced one or two or even no otters per year as freezer fodder, such was their rarity following their almost complete demise resulting mainly from use of agricultural pesticides.

Dieldrin, aldrin and heptachlor were all persistent agri-chemicals introduced in the mid 1950s as seed dressings, sheep dips, moth proofing and timber treatments. They were banned in 1962 as seed dressings for spring cereals; in 1966 as sheep dip and in 1975 for the treatment of autumn and winter sown cereals. These chemicals, not to mention PCBs, mercury and lead, accumulated in animals and birds at the top of the food chain, in particular otters, to the extent that it disrupted their reproduction. By the mid 1970s severe declines in otter populations in the UK (and Europe) were such that they were left only as remnant populations in Scotland, parts of Northern England, parts of Wales and the West Country. Once these chemicals were banned the populations gradually rose to the point where road casualty otters are now measured in hundreds, sad for the animals but a useful index of abundance, and the otter is now present once again in all UK counties.

What you may ask can we learn from a dead otter? A great deal is the reply. Over two decades we have asked and answered many questions about these animals. We have plotted the rate and extent of range expansion from the small remnant populations in mid-Wales, the south-west of England and northern England, until now, when there are few rivers and few areas of the UK to which otters have not returned. We have followed how the pollution and pesticide levels in their bodies have changed with time and even plotted a convincing reduction in lead content of bone in the twenty years following the removal of lead from petrol. From post mortem examinations we can see from uterine scars the number of cubs they produce; from tooth sections the age of individuals at death; stress factors can be judged by adrenal gland size; bone development can indicate juvenile age; kidney stones can be related to age and diet; stable isotopes can indicate food sources; police may be interested in gun shot wounds; the incidence of parasites particularly of the gall bladder has given valuable information on parasite spread; scent gland analysis opens up the world of inter-otter communication and genetic work shows the origins of our current population

whether from residual populations, rehabilitated individuals, or even possible illegal immigrants.

The spraints (faeces) of these animals provides insights into diet and how it changes both with location and time and fresh spraint can provide genetic material from which to identify the living individual. Combining aspects of these data has also helped identify accident blackspots for otters resulting in improved road design and mitigation. An awful lot can, therefore, be gleaned from mainly road casualty, dead otter material.

Our interest in wildlife road casualties initiated not only our work on toads and later otters, but was in itself, a fruitful field of study. At that time we had a PhD student from Exeter University studying polecats in the wild, but we also kept a number of cage bred genetically pure polecats which we fed mainly on chicken heads. Excess chicken heads, treated in various ways, dyed, halved etc, were supplemented by surplus laboratory mice, assorted small and medium mammals and used as surrogate wildlife road casualties. In addition to a weekly survey of 70km of local roads of various classifications by car and bicycle, experiments were conducted on roads artificially seeded with "road casualties" and removal times noted. Surveys had been conducted in the past of wildlife kills on roads by simply counting the number of bodies on a set length of road. This, we found, was unsatisfactory, as most road kills below the size of a squirrel or hedgehog, were gone within twenty minutes and particularly so within about an hour of dawn. Road topography influenced the results as narrow roads with high sides often led to more badger casualties and birds swooping down the side of such cuttings led to more passerine deaths. Season was also a factor as it seemed that, for example, hedgehogs moved from the hill pastures into the more sheltered valleys in the autumn, making them more vulnerable to road death. Verge management was also a factor as, when an improved road junction was reseeded with ryegrass in a landscape of poor upland pasture, many rabbits became vehicle fodder. We also found that when migrating toads are forced to

cross newly laid, and probably still slightly warm, tarmac, they are killed, presumably by the fumes, before they could get squashed by the expected hazard of traffic.

Ponds were a quintessential feature of the classical rural landscape, until that is, fields were drained and alkathene pipes fed mains water to field troughs. You can see the logic from the farmers' point of view, drier land with less foot rot, clean water reducing liver fluke and the list goes on. From the naturalist's point of view it is habitat lost and, in the often cyclical world we live in, conservation ponds now get farmers "Brownie points" in stewardship schemes and the national body once Pond Conservation but now the Freshwater Habitats Trust specializes in pond protection. In the 1980s we undertook a comprehensive survey of mid Wales' ponds and rapidly became aware of how varied they were; upland peat pools, mawn pools, ephemeral ponds, farm ponds, conservation ponds, garden ponds, ox-bow ponds, all with their different characteristics. It enabled us to produce inventories of the plant and animal life of these ponds, how they were utilized, and what was their water chemistry. Contrary to evidence in an atlas of amphibian distribution published in the early 1970s which showed much of mid-Wales devoid of such creatures we found frogs, toads, palmate and smooth newts to be widely distributed. Similarly great crested newts, which, when I first arrived here, I first found as an item of flattened fauna which I peeled off the road near Llanelwedd Quarry at Builth Wells to become the first local record, but our subsequent surveys found them to be widespread. Out of about a hundred ponds surveyed, fish, and then only sticklebacks, were found in just one, unlike many sites south of the Brecon Beacons where fish and particularly this species, can be very numerous.

Some of the shallow, short-lived, ephemeral or semi-ephemeral pools of upland Radnorshire, east of the Wye, were shown to be particularly interesting and in consequence one of my last PhD students Anna Bransden reignited my enthusiasm for this rare and neglected habitat. In the 1980s I published a paper

about a previously undescribed association of plants from these pools which included the nationally scarce, grass-like fern, pillwort, making these ponds comparable to the better known ephemeral ponds of the New Forest. In the 1980s some of the ponds on the Maelienydd of north Radnorshire were famous for their roosts of hundreds of waders, there is a good historic photograph of them in the New Naturalist book on Waders, but now these birds have gone as also have the black-headed gull colonies such as Llanwefr Pool, which came and went as a nesting site almost within the span of the twentieth century. Another rare organism in a few of these ephemeral pools is the fairy shrimp and although it had been reported from a single Radnorshire site in the early 1990s and subsequently a few other sites, Anna's survey work found several new sites for the animal and a whole batch of new records of often scarce invertebrates which were utilising these ponds. She was also able to look at these waterbodies in terms of fluctuations in level and water quality in relation to rainfall and catchment area. Most ponds are just temporary features in the landscape, if left to their own devices as they will fill with aquatic debris and eventually become dry land as part of the natural hydrosere succession. These very shallow, short lived ponds, found on the flat tops of these generally peat-free hills of Radnorshire, might be thought to have a shorter life than more conventional ponds, but their shallow nature and regular drying allows any accumulated debris to blow away so that they are pristine on each refilling which can potentially happen indefinitely giving them almost infinite life.

Except for the toads of Llandrindod Lake, we have not done a great deal of work on larger water bodies. But, utilising MSc students, we studied the stunted bream population at the Lake which then numbered over 100,000 individuals. Subsequent introduction of fish eating perch caused the bream (and possibly the toad) population to decline. This may also have affected the only population in Wales of the bitterling, a fish that requires the swan mussel in which to lay its eggs. However, more recently, draining the Lake and removing the silt, and in the

process killing the swan mussels, is probably the main reason why this interesting fish is no longer reported.

We also surveyed Llanbwchllyn Lake, once the most botanically rich waterbody in Radnorshire and famed for its aquatic plants, before and after it had been treated by Welsh Water with copper sulphate to clarify the water for human consumption. The important stoneworts and other aquatic flora were gone and soon after the damage was done abstraction for the public water supply stopped, so another pointless and destructive public venture had the predicted outcome. The site is now a nature reserve and is regaining some of its previous interest – at this site it is always good to impress companions with “bravery” by stone turning to find and hold the large, but relatively harmless, horse leech! It is also a possible site ear-marked for the release of beavers which doesn't make me quite as happy!

What are my biggest concerns regarding mid Wales' wetlands, be they rivers or still waters? Other than I believe the ill-advised release of beavers, which seems all but inevitable, will quite conceivably be an environmental disaster, the biggest environmental danger would be the continued spread of signal and possibly other non-native species of crayfish with little prospect of control and the possibly even more serious the spread of New Zealand pigmyweed (*Crassula helmsii*), the latter now spreading through some of those special ephemeral pools systems in mid and south Powys as well as many more run of the mill water bodies, a seemingly unstoppable alien invasion. The riverside invasive, Himalayan balsam threatens to embalm the river banks of Wales with consequential negative effects on bankside species and the river banks themselves.

The otter, but not its prey such as eel, salmon and crayfish, seems to have been saved from the brink of extinction, but, with the perspective of time I am sure more trials and tribulations lie ahead for the rivers and wetlands of Wales.

3. Fuelling My Research – Woodlands Old and New

The history of mid-Wales is closely linked with woodland cover. The ancient hill forts overlooked a treed landscape with sessile oak on the hills and pedunculate oak, ash and alder in the river valleys. The even more ancient history, readable only through the pollen and plant macrofossils layered into peat deposits, shows how Wales after the last Ice Age, some 10,000 years ago, went from a landscape of open herbaceous tundra through dwarf birch, to tree birch to pine and eventually mixed deciduous forests, until man began to clear them for agriculture in Neolithic times and much later coppiced woodlands as fuel for heavy metal extraction. This is perhaps a convoluted way to bring peatlands into the story, but as a fuel, peat was a staple source of heating material for thousands of years until the arrival of the railways, and, in the hills of Wales, as the peat erodes, 3,000 year old timber from forests which pre-dated the peats frequently comes to light.

In my undergraduate days at Aberystwyth, the then Senior Lecturer in Ecology Mr. E H Chater and Peter Moore, later to become Reader in Ecology at King's College London, studying for his PhD in peatland stratigraphy and palynology stimulated my initial interest in peatlands. After an undergraduate dissertation on the pollen history of Maesgolau Bog in Cardiganshire, I studied Wem Moss in Shropshire for my MSc and later returned to Aberystwyth for my PhD studying the flora of Borth Bog (Cors Fochno) and other Welsh peatlands.

The basal peat deposits Borth Bog in the Dyfi Estuary, extend well out to sea as is evidenced by the "sunken forest" visible along the shoreline. Sea level change and the development of the sand spit on which Borth village now stands, cut off a marsh through which the River Leri flowed and, in time, one of the finest, relatively intact examples of a maritime raised bog in England and Wales was formed and is now given the protection of national and international designations. Not that the site has not been influenced by man through peat cutting, fire, general drainage and agricultural reclamation. It was the latter which caused great shrinkage of the peats on the western side of the raised dome which recent

management measures have endeavoured to reverse. The intact surface has a rich flora of *Sphagnum* (bog moss) species including *S. austinii* (previously *S. imbricatum*) now just a few clumps, but the species from which most of the older, deeper peat is made. The western edges carry black rush (*Schoenus nigricans*) a species which botanically links the site with Irish peatlands. There are interesting invertebrates present such as the rare rosy marsh moth, first known only from eastern England where it was believed extinct until it was refound here and subsequently at a few other western sites where it feeds mainly on bog myrtle. When I worked on the site in the early 1970s, a flock of up to several hundred Greenland white-fronted geese was my frequent winter companion, as the birds came in to feed on the white - beaked sedge bulbils and above us the sonic boom of Concord on its test flights would lift the flock in to the air. I have long left the site and so have the geese and Concord is now a museum piece. So saying I have returned to the site intermittently over the last 40 years to monitor the changes in the level of the bog following the blocking of drainage ditches on the western side. The most obvious change, after noting the recovery of the peat, is the constant sound of calling Canada geese, not a species to miss the opportunity to colonise some open water, in this case the ponding created by ditch blocking.

When I moved from Aberystwyth to Llysdinam my interest in peatlands came with me and so I employed Pat Wisniewski and Louise Paull who had previously worked on the toads of Llandrindod, to undertake a survey of the peatland resources of Powys. Later Dave Wilkinson looked into the Flandrian history of Llanbwchllyn Lake, using the peripheral peat deposits, particularly in reference to the comment by Giraldus Cambrensis on his Tour of Wales in 1188 that this lake had famously burst in historic times, but our evidence, from carbon dating, suggested that it had burst, but some 8,000 years ago. Field Centre staff have, at various times, taken an interest in the flora and fauna of local peatlands, such as investigating the distribution of the rare lichen *Cetraria sepincola* on the fine

branches of birch on peatlands and an intensive study of the water rail on Aberithon Turbary at Newbridge.

My interest in peatlands took me to conferences in many peaty places. Israel is perhaps not associated with wet peaty places, but back in Biblical times, north of the Sea of Galilee, was another great lake in the Hula Valley, now filled with 30,000 years of deposition of papyrus peat. Most of this area has been reclaimed for agriculture and was covered in migrating European cranes when I was there, the remains of the Hula Lake and its Nature Reserve, are now just a small fragment of its once extensive past. Strange to see a peatland where ditches were not for drainage but for crop irrigation from the nearby Jordan River.

Israel at that time was very strict on border controls and it was an interesting experience on leaving the country to be questioned on why I had been there and trying to explain in simple English the concept of peat to the two security guards, who for their standard passenger check had already got me stripped to the waist and were thoroughly frisking me in a cubicle little larger than a toilet, producing that feeling of unjustified guilt, but for what I did not know. The country was then a little jumpy with military vehicles driving parallel to all aircraft on takeoff, to fire metal chaff to disrupt any incoming anti-aircraft missiles. Armed guards at a wedding I attended near the country's northern border, constantly patrolling around the guests and one guard with a sub-machine gun on each empty waiting bus also illustrated how much vigilance was needed even in everyday life. On this trip I first tasted falafel from a street vendor in Jaffa, attended my first Jewish circumcision (a Brit) – no anesthesia so baby less than appreciative! and lived for a week or two with Liz's half brother and his family on a kibbutz, all adding to a memorable visit to this unstable land.

In the USA I went to Minnesota to see their vast peatlands including the Upper Red Lake Peatlands, now protected, but which was once under threat from gasification plans. In total, peatlands cover some 585 square miles, of which

about half have protected status. Peripherally the area shows the scars of man's activities, with considerable areas of abandoned, reclaimed grassland and other areas of drained peat where fires have cut deep in to the peat deposits. Some areas still grow Kentucky blue grass and black rice and in isolated recreational areas sewage filtration through peatbeds has reached a fine art. But this is really the land of treed peatlands, sundews, pitcher plants, bald eagles, black bears, wolves and moose and long may it stay that way.

More meetings about peatlands took me to both Finland and Poland before the soviet influence in Europe declined and both countries I found interesting, if different, experiences. In Finland, in the early 1970s, Rune singers would be in genuine floods of tears as they sang about families divided across the artificial political boundaries of that part of the world and soviet delegates were accompanied everywhere by heavily built "friends". But here we had a land of two thirds peat cover much either extracted for fuel or drained for forestry. As drainage causes the peat to oxidize and decay away, after two or three rotations there is insufficient substrate left above the granitic rock to sustain further rotations of forestry on that site. These problems have been acknowledged and addressed and the area remains as beautiful as ever, but is the only place where, after a day on open peatlands, so called aapa mires covered in naturally bonsaid pines, that I have had over one hundred horsefly bites through my shirt, across my shoulders and back – yes, I had someone count them!

Poland in those days of the '70s was nothing like today's modern country. In Poznan two hundred people were queuing past our hotel at 06.30, so I asked the reason. A delivery of sausage was expected at the butchers, no meat just sausage. Shops were empty of food, the posh hotel I was staying in listed but could supply no cereals for breakfast, and the waiters made it clear they resented the presence of western Europeans (we had been put in to a different hotel to eastern European guests and charged twice the price). Later that day the government put on a reception for us at a state farm, and then we saw why we

were not always welcome, as the menu was long and lavish out of the grasp of even affluent Poles. A book on World Peatlands was being put together by A J P Gore back in the UK and a chapter on Russian peatlands was required from the acknowledged expert Professor Victor Masing. Because of censorship rules in the USSR he could not send such a manuscript to the UK so I was asked to discretely meet him during the conference, collect the papers and bring them back to Britain. I managed to see Victor when his minders were not around and suggested we should meet in his room “No” he said “walls have ears – we meet in the bar”. In the bar I was instructed to interleaf his manuscript between the pages of my typed presentation, “If you are stopped they will not find them there” I was told. As I left for the airport I could not help wondering if his minders had seen us in the bar and if I was going to leave Poland that afternoon or not – the fates were kind and I caught my flight home but not before it had been boarded by gun toting border police demanding to see passports – fortunately the problem was that an air steward had miscounted the number of passengers!

In Gdansk we visited Westerplatte where the Second World War began when the harbour was shelled by German warships. For a better view I climbed the grassy bank near the commemorative monument and foolishly took a photograph of the port on the other side - a military installation I was later told. “Soldiers – get away quick” came the call from the rest of our group in the crowd down below. As the soldiers came up the bank I rapidly descended and fortunately mingled in with the crowd sufficiently for them to give up their pursuit. Some events were amusing if sad. We stood on a viewpoint above the city and noticed a man in a long grey raincoat moving around the visitors, rapidly opening then closing his coat. I had heard of flashers and when he reached our group open went the raincoat to reveal – fish, half a dozen large Black Market dinners!

I returned to Gdansk, Poland’s city of amber, some twenty years later. The soviet troops were no longer in the country and the Solidarity movement which meant so much in their liberation was also long gone and the big event on our arrival in

the city was the opening of the first drive through McDonalds bedecked with a super-sized ketchup bottle shaped balloon. A sad reflection on “progress” but at least the shops were full. In general people seemed happy but there was an undercurrent of lawlessness in certain areas.

With Peter Randerson, my collaborator with all things filtration and biomass, we were visiting Professor Piotr Kowalik at the university in Gdansk. Peter and I decided to explore the part of the city where we were staying – in accommodation formerly reserved for communist officials in the local Dr Oetker cake factory. The following morning we recalled our host who was visibly shocked particularly when we mentioned the “fireworks” we had heard. They were not fireworks but feuding gangs and we then understood why everyone seemed to have bullet-proof steel doors on their apartments and never left cars unattended on the street, keeping them in guarded compounds. People preferred to live in rented flats even if they owned holiday cottages in the country and were proud to show us impersonal blocks of flats, at one time said to be the longest in Europe and were also keen to show us their two roomed two person and one roomed one person flats – and one room meant just that. The reliability of public transport put the UK’s to shame. Trams ran every seven minutes and the city metro trains every 14 minutes, were very cheap to use, and rarely if ever did they run late.

I visited Poland on several occasions but this time we were visiting some of the biological filtration installations in and around the city including peat, sand, willow and reed beds. The city zoo filtered the water from its hippopotamus and other enclosures through a natural filter system, a relatively modern concept but that contrasted with the less than modern state of some of the animals which would not have been tolerated in the UK, particularly the cramped cages. In other places we visited of various natural filtration systems including biofiltration systems for entire towns utilising the reed fringed wetlands bordering the Baltic Sea. This part of northern Poland is generally very flat with numerous extensive

wetlands through which routes for canal boats are maintained and where the boats are transferred from level to level not by locks as in Britain but lifted in dry cradles, a unique Polish experience!

Conferences are good places to meet people, network and learn what are the latest ideas in your own area of expertise and with peatlands a great deal of work was going on at that time into using peat or degraded peatland as a substrate for the filtration of waste water to remove nutrients, metallic pollutants, bacterial contamination, organics and even oils. In the USA such filters were being used on camp sites far from municipal sewage treatment and were found to remove virtually all coliform bacteria and reduce the biochemical oxygen demand caused by organic waste. I was aware of areas of degraded peatlands in Wales where bogs had been drained and often planted with conifers which had failed to thrive so the idea of using Welsh peatlands for filtration was born.

In other parts of the world, peat extraction as fuel was leaving vast tracts of Russia and northern European with so-called cut-over peatlands, where most peat had been removed, leaving a thin organic layer over the pre-existing soils. We considered that there were two main potential ways of exploiting these areas; one was to reflood them creating the template for new peat growth, but this would take decades at least before a new crop of peat was formed, or plant the cut-over areas with a crop which could be harvested in place of peat. I had had some contact with a group in Ireland who were starting to grow closely planted willow on a three year cropping rotation – so-called short rotation willow coppice (SRC) and thought that here might be the answer to the problem. With Peter Randerson, my colleague in Cardiff, we put together a collaborative project with university colleagues in Tomsk, in Central Russia (London – Moscow 4 hours flying time; Moscow – Tomsk 4 hours flying time) with the object of planting up the areas, exhausted of peat by the electricity generating industry, with short rotation willow coppice. Both parties were keen and the funding seemed in place but, as not infrequently happens with such applications, red tape prevented it

going ahead. Disappointing, but we had also had a few difficulties in convincing potential staff that four years in Tomsk, where summer temperatures reach 40°C and winter temperatures -40°C combined with the bleak Russian landscape and unfamiliar language and culture was an employment opportunity not to be missed!

Not to be discouraged we put our ideas forward to the Water Resources Centre (WRc) that we should plant a woodland of short rotation willow coppice (SRC) on a degraded peatland and use it to treat farm effluent. Great, said WRc but can we modify it slightly? A slight modification meant out with the SRC, out with the peatland and out with the farm effluent and in with digested domestic sewage sludge applied to an existing birch woodland on mineral soil. But, offer us money and we will do the work. Sarah Lynn did an excellent job and we determined the best rates of application and times of application of the sewage sludge and related these to the effects on the woodland ground flora and fauna. She found that applications of sludge decomposed far quicker from an autumn than a spring application, presumably because the soil fungi are then geared up to annual autumnal leaf decomposition. Linked to that, it seemed that plants such as Bramble grew better in the second year after application, suggesting that it takes some time for the nutrients from sludge decomposition to become available to higher plants. When spreading this six to twelve month old digested domestic sewage using a bowser, it generally “broke wind” as the final contents of the tanks were aerosolled into the air – an event usually followed a day or so later by what was politely called a gastric rotavirus infection.

As good as this project was, it was not quite what we had intended, so we took the opportunity of some PhD funding to plant willow coppice not quite on degraded peat but on a wet field of peaty soil at an altitude of 300m where we could use a range of soil amendments. We had been told in no uncertain terms that SRC willow was not feasible in the Welsh uplands and that SRC as a biomass crop for chipping and burning would not catch on. Over the next few

years first Rachel Hodson then Rebecca Heaton then Simone Lowthe-Thomas and Rachel Smith at first planted willow trials to test out new varieties then experimented with ways of planting, harvesting, fertilizing and using willow, and then later we brought in new biomass crops, this time grasses such as *Miscanthus* (elephant grass) reed canary, prairie cord and switch, plus giant reed (*Arundo*), demonstrating our belief that biomass crops would be important in the future was not a figment of our imaginations

We had however, not forgotten about our interest in using willow in biofilters and when Powys County Council approached us about a problem they had with water quality of effluent from a closed domestic rubbish site at Nantmel, we agreed to design filter beds incorporating willow. The final design incorporated a reedbed leading on to two willow beds, as each had a different role to play in cleaning up the water. We set up a very expensive bit of equipment to monitor the way the system worked but we had not factored in the likelihood of flooding of our instrument house – an expensive (£30K) mistake when the flood came!

When the same sealed rubbish dump burst and sent a much greater amount of effluent directly in to the adjacent stream, a much bigger filtration scheme was needed which ended with the treated effluent passing through two field sized grasslands, the outflow water of which, I was told, was good enough to drink. We designed a much bigger treatment regime for Powys at Ystradgynlais where almost treacle like effluent from an active tip needed our intervention. After the water had been aerated for several days using an air pump in a holding lagoon, it was passed through five vegetation filters of various designs into a final pond which contained fish – if they survived the system was working – and they survived!

In North Wales, the National Trust in the Conwy Valley had a problem with farmyard washings from one of their properties ending up in the river and they were also interested in running the farmhouse heating on biomass derived from

the farm. Here we came up with a series of interlocking S-shaped filtration ditches planted up with SRC willow so that the nutrients from the mucky yard washings would be incorporated into the willow so enhancing its growth, providing more biomass for the farmhouse boiler and clean water for the river.

One aspect which concerned us with these new biomass crops was their effects upon wildlife and the environment. Danielle (Danni) Fry looked at this from the point of view of SRC and Jen Clapham studied the biomass grasses. The willow work was undertaken jointly with Aberystwyth University's Institute of Biological, Environmental and Rural Sciences (IBERS) formerly the Welsh Plant Breeding Station (IGER). IBERS was undertaking EU funded research into the feasibility of SRC willow crops at various locations in Wales and we were contracted to do the ecological fieldwork. Danni and I travelled regularly to two sites one near Ruthin and the other near Denbigh in north-east Wales, Bodorgan Estate on Anglesey, which is the estate where Prince William and Kate lived while he worked as a helicopter pilot at RAF Valley, Glynllifon Agricultural College near Caernarfon (now Coleg Meirion-Dwyfor Glynllifon) and in Pembrokeshire at sites at Bluestone and Hayscastle. These were in addition to our own local SRC sites at Llysdinam and Hundred House near Builth. At all these places we mist netted birds, trapped small mammals and recorded the vegetation over three years, in order to evaluate the biological impact the crops were having. In the present grass dominated, pastoral monocultures of Wales there are diminishing seed resources for small birds. When mixed farms predominated there were always autumn stubbles to provide forage. SRC can be viewed as almost an arable crop, as ploughing prior to planting disturbs dormant weed seeds and gives a good seed crop in its first year if largely unnecessary strict weed control is not undertaken. At the end of a three year rotation the field is once again open and without more intensive weed control, which again is not generally necessary, another seed crop is produced. With different stands at different stages in the rotation it is possible for there always to be weed seeds with sensitively managed crop husbandry.

The fields which we studied certainly brought in a rich diversity of wintering seed-eating birds and in summer the warblers and other birds of young woodlands to breed. Voles and wood mice were common round the edges of the crops with mainly wood mice and yellow-necked mice venturing in to the centre. Badgers and foxes moved through the crops and, in dry periods, the damper soils within the canopy brought badgers in looking for earthworms. At some sites other factors came in to play. At our site near Denbigh, which was on a hill, hares badly damaged the crop and at Bodorgan our site was wet enough to attract regular groups of wading birds. The vegetation varied from site to site, but for plants such as spear thistle, its seed heads seemed to be foraged mainly by finches while the plant was upright but as winter progressed and it fell, finches were replaced by thrushes and blackbirds. It had been asked if these blocks of willow scattered across the landscape would act as stepping stones for birds isolated in a sea of grazed grass and we would conclude that the answer would be yes.

The opportunity arose for Danni and me to visit an SRC site at Taupo in New Zealand and catch and ring, with New Zealand rings, the birds of the coppice which were, with a few exceptions, almost identical to the species we caught in Wales, a case of transferable agricultural practice having transferable environmental results.

For our energy grass studies we were building on work Dr. Tsehaye Semere did for us mainly at Herefordshire borderland sites around Shobden, Lingen, and Leominster under contract to what is now the Department for Environment, Food and Rural Affairs (DEFRA). Here we were looking at the biodiversity of *Miscanthus*, reed canary grass and switch grass in terms of mammals, birds and entomology. The project worked well except that the switch grass failed to thrive as this C4 plant, a plant best suited to the continental climate of mid-USA, could not compete with native weeds in its seedling stages and some areas of

Miscanthus were heavily grazed by fallow deer, a problem we do not have in mid-Wales.

We also had access to *Miscanthus* sites near our Bluestone willow sites in Pembrokeshire; indeed, we put in the first such plot at and for the Bluestone holiday complex where large installations such as the swimming pool are now largely heated using biomass crops.

We also had additional crop sites at Gelli Aur College campus at Carmarthen, the National Botanic Gardens, where we created a biomass crop exhibit for them; IBERS sites at Bow Street, Pwllpeiran, and near Llanafan all in Ceredigion, as well as sites at Llysdinam and Richard's Castle and Bishop's Castle to the east. These gave plenty of opportunity for Jen to select sites for biodiversity studies and for Rachel to work on the effects of nutrient enhancement. Both these PhDs took forward our understanding of the respective topics but it was the discovery of the importance of these crops to harvest mice and water shrews, at least in our Pembrokeshire sites, that reinforced my belief that biomass grass crops and SRC have the potential to enhance the biodiversity of Wales, provided such sites are not swamped with the commercial pressures from chemical companies to botanically sterilize each crop and who knows what else.

My chapter title refers to woodlands old and new. What I have described in relation to short rotation willow coppice refers to a new type of woodland which may well become more apparent in the countryside as we continue to phase out fossil fuels. The old woodlands of mid-Wales are characterized by the hanging sessile oak woodlands which once draped along many of our valley sides. Today many have gone, evidenced only by a field of bluebells or a conifer woodland amongst the tree stumps of felled oaks. When, in the 1960s, I helped survey the deciduous woodlands for a proposed National Park of Central Wales, just west of Llysdinam around Troedrhiwdalar, we recorded the most extensive area of such woodland in the proposed park. Its dissection over the next few decades into a

few discrete, relatively small areas due to clearance for farmland, quarrying activity and its replacement with conifers, is the story of many of the woodlands of the former Brecon Bluffs from Newbridge to Llanwrtyd, and further afield. Like peat, oak was once fuel for the farm, and through regular coppicing provided both logs for the fire and fencing stakes. In mid-Wales many acres of oak coppice were used by the lead mining industry, denuding the areas around such mines of any trees. Sadly sessile oak woodlands are no longer coppiced and it is doubtful now if many would regenerate if cut back after decades of neglect. But, although such woods, grazed by centuries of sheep, low in botanical diversity, and not naturally regenerating because of shoot eating sheep and acorn eating small mammals and insects, they are undoubtedly one of the most exciting habitats to visit in summer for migrant birds.

Here we get the pied flycatcher, a specialist of western grazed oak woods; wood warbler, a bird whose characteristic call gets scarcer each year; together with its relative, the much commoner willow warbler, and the redstart, the male being probably the most colourful of small woodland passerines. Buzzard, red kite and raven all nest in some of the various woodlands I have studied, together with the usual residents one would expect in woods and gardens. Although Jo Robertson did her PhD studies on the blue and great tits of local woodlands, usually ones with a shrub layer, so generally shunned by pied flycatchers, almost all our other studies on these woodlands have been in relation to the latter.

When I first came to the Field Centre, Chris Mead of the British Trust for Ornithology (BTO) was a regular visitor to the estate and invited to ring the nestling pied flycatchers in the nest boxes provided by the estate owner Sir Michael Venables Llewellyn and owned before him by his father Sir Charles. Sir Charles put up his first nest boxes at Llysdinam in 1911 and monitored them through to the Second World War. This is thought to be the first such nest box scheme in Britain but sadly the detailed records were lost when Llysdinam House was cleared during the war. Fortunately Sir Charles published a summary of the

records and many of his observations. One such record was of a bird which laid odd shaped eggs and when, in the following year, almost identical eggs were laid in an adjacent box, he concluded that the birds must return to the same woodland in successive years, results we could only confirm in later years by ringing.

“Why should I come all this way to ring these birds when you are here” said Chris Mead, and so I began several years of training, both in the UK and abroad, to become a ringer and to work my way up the qualification ladder to eventually obtain my Bird Ringer’s A Licence. Then, the few tens of boxes we had around the estate did not satisfy my enthusiasm and Maurice Slater, my uncle, who lived with us in Newbridge-on-Wye in his later years, was a superb craftsman and volunteered to make the vast majority of the 1000 or so nest boxes which I eventually monitored in woods mainly around Llysdinam but also some as far away as Herefordshire and Shropshire. There were years when I put rings on the legs of over 2000 pied flycatcher pulli (chicks). Not surprisingly I received results of many recaptures of my birds from Britain, Europe and Africa making it possible, from my work alone, to plot their migrations to and from our Welsh woodlands, usually via the French and Iberian coasts and on into north- west Africa with a return path a little further to the east. In the ringing hierarchy I moved from just an A ringer to be a trainer and over the years many aspiring bird ringers came under my wing. Cardiff sent a number of PhD students to carry out their ornithological work using our woods and boxes.

It was in 1992 that Professor Mike Kern from the University of Wooster in Ohio, USA, first started his annual visits to Llysdinam, accompanied by his wife Alice, to study the pied flycatchers nesting habits in a number of our woodlands. This work continued virtually annually until 2005 and from it he published several papers, adding to our understanding of this well loved bird. Sir Charles’ observations from the early part of the last century that birds returned to their natal woodlands proved accurate as Mike found 53% of male and 42% of female

pied flycatchers plus 3% of the young return to the same woodland to breed. Sadly numbers breeding have declined over recent years but they now breed somewhat earlier than they used to, presumably to remain synchronized with the caterpillars which feed on the very young, tannin free, leaves of oak, ideal for feeding to young chicks. These, mainly oak tortrix moth caterpillars, can, in some years, occur in vast numbers, virtually denuding the trees before descending on silken threads to the woodland floor to pupate. By intercepting their descent with water trays on the ground, I found that, in some cases, a density of descended caterpillars of about 1000m² demonstrated why the trees above were leafless.

Other than the hard science which such nest box data can provide, there are also the associated ecological anecdotes provided by this large and long term study, such as fourteen pied flycatcher eggs in one box (normally a maximum of 7), presumably two confused females; extra large, extra small and cigar shaped eggs, reminiscent of Sir Charles records; mixed broods of pied flycatcher and blue tit chicks in the same nest; a great tit which returned to the same box for three successive years and annually laid and incubated one infertile egg without any nesting material whatsoever; chicks with what Chris Mead would call “gummy beak” but seen less frequently recently; Chris again, this time sitting, trousers down, on an outside toilet at the RSPB Dinas Reserve shouting to us to come and see what had been written about the BTO on the wide open toilet door; birds rescued after being trapped in boxes by a filament of hair or wool; pied flycatchers starting to build a nest in a box that was still wet with creosote wood preservative and successfully rearing a full and healthy brood; our autumn survey of boxes in the hunt for the copper underwing moths; the reaction of students when I wanted to show them the first hornets’ nest I had ever found in a nest box (wasps, however, very common); the line of 30 nest boxes all taken by a weasel which must have followed our scent from box to box, and was that really a pine marten I saw in one of our nest box woods?

Even in retirement I continue to monitor the nest boxes at many of my sites to maintain this link of continuity going back now over a century. Bird ringing does give you the excuse to travel, and although I do not profess to be a fanatic birder, I have enjoyed the opportunity to ring birds abroad, not only in New Zealand but in also in Majorca both when I was learning the trade and later as a consultant, as well as marveling at the ornithological riches netted in the riverine forests of Sabah.

My uncle not only made bird boxes but also hundreds of bat boxes, which were erected not only in sessile oak woods but also in riverside, mainly alder, woodlands. Most get occupied around Llys dinam by common and soprano pipistrelles, brown long-eared, and in a few favoured boxes in early autumn, by noctules. By the river Daubenton's are frequent occupants. While putting up some riverside bat boxes in woodland near Llandrindod, accompanied by a dozen chattering students and a noisy aluminium ladder, I had just extended the ladder and was resting it against the tree when several students pointed out a black animal approaching us. Unfazed by the noise and our presence, a mink ambled past the students and under my ladder, no more than a metre from me, such a contrast to the usually elusive otter.

It is one of the most widely distributed plants in the world and here in Wales there must be thousands of hectares of almost pure stands of bracken, usually regarded as a pest, it has been suggested as a possible biomass fuel crop and seems a good candidate crop for producing bioethanol, and although some control has been attempted, very little impact seems to be made on the extent of its dominance. Although it may be a preferred habitat for the whinchat and nightjar and a the food plant for range of butterflies and moths, it is not often seen as a asset to biodiversity possibly because sheep ticks loiter there to potentially pass on a number of diseases to humans and livestock including Lyme Disease. The plant has, in the past, been used as animal bedding, for tanning leather, in soap and glass making, for garden compost and as a fertilizer.

In Mid- Wales the autumn hills are still often dotted with the brown bales of bracken, harvested for stock bedding. In some ways this plant is a rogue, but nevertheless deserves admiration for its evolutionary ruthlessness. It is toxic to most livestock and outcompetes and maintains dominance over almost all moorland plants. The young fronds are eaten, particularly in the Far East, and have been linked to human stomach cancer. Elsewhere the rhizomes are collected and dried for their starch content. It is also thought that the spores are carcinogenic and in places are filtered out of drinking water. Although some insects will feed on the plant it is known to produce alpha ecdysone, a plant version of the insects' moulting hormones, disrupting the creatures' development. It also produces thiaminase, an enzyme which breaks down vitamin B1, thiamine, which, in humans can lead to beri beri and in insects to simple vitamin deficiency. It has nectarines on its stems which attract ants who, in return, remove herbivorous caterpillars. To reduce plant competition it produces compounds which inhibit the growth of other plants and a separate substance which inhibits the germination of seeds. A fascinating plant for Judith Scott who undertook her PhD study of Bracken, examining the way it was spreading particularly in relation to nitrogen pollution from rainfall. By far the most polluted places for nitrogen deposition were found to be hills which regularly get capped with cloud and result in so-called occult deposition, which can deposit many times more nitrogen than simple rainfall does in the valleys. Judith's set of automatic weather stations also gave us a useful baseline of local climatic variation which we made use of well after the project finished.

Another fuel source has also occupied my time in the last few decades and that is wind. It is a very contentious issue and there are still people who do not speak to me because I provided the ecological evaluation for the Bryn Titli wind farm near Rhayader way back in 1993. Since then I have been involved in wind farm developments from Cumbria to Ceredigion. My biggest input has been in to the proposed Garreg Wen site on the Llanbrynmair Moors of north Powys. The plans, which change with time, were to put some 90 turbines across some 30km²

of mainly coniferised countryside. Although widely opposed, as are many such proposals, I took on the job because I believed this was the way forward and the countryside would be enhanced by this project. Once the Llanbrynmair Moors were some of the finest and richest upland areas in mid-Wales with SSSI quality lakes and peatlands, but then in the 1970s, came the rich and famous, reportedly including Cliff Richard, who were intent on investing in coniferous forestry, as it was an efficient way of managing taxation. Beautiful upland country all over the UK, including parts of the superb Silver Flow country in Galloway, was coniferised for cash. At Llanbrynmair, 50km of forestry roads went in, the trees were planted and the SSSI peatlands were partly drained. Proposals for this windfarm put forward by RWE npower Renewables would, in addition to the turbines, clear the conifers, reinstate the moorland, rejuvenate the SSSIs and make the place better for wildlife such as the black grouse and hen harrier effectively linking in bird terms, with the RSPB holdings north of the Banwy Valley. Sure there would be turbines but they would be carefully located away from homes and harrier nesting sites and would be tall enough not to cause a problem for the black grouse. The management plans were carefully drawn up to ensure the continuity of key wildlife, a big project I was proud to be associated with in spite of the often brown rice and sandals nimby opposition.

Harvesting of fuel in mid-Wales has changed over the years; peat and woodland logs predominated before the railways came and brought coal to the masses. We are now looking at new ways of harvesting fuels from the countryside by growing trees or grasses on short rotation for combustion or in the future converting them to ethanol or hydrogen at the same time harvesting the wind from "*one of the windiest places in the settled landmasses of the world*" (Prof Jim Taylor, Aberystwyth University)

4. A World of Difference - Pakistan

In Search of the Blind Dolphin

It's a bit complicated really how I came to be in Pakistan for a few weeks around the turn of the century. In simple terms, a PhD student came to work with me from the University of Sindh, in southern Pakistan, but the Welsh environment took a toll on his health so he returned home, unable to pursue his proposed research on Welsh otters. Instead, he decided to work on the ecology of the endangered Indus river dolphin, sometimes called the blind dolphin, co-supervised by two professors in Sindh and myself several thousands of miles away and with no direct experience of the Indian sub-continent or its wildlife!

In Wales, I was used to setting up projects to study subjects and locations with which I was familiar, but in my naivety, had not appreciated even the logistical difficulties of doing the same thing wearing the blindfolds of ignorance and distance. The easy bit for me was mugging up on the animal concerned, having the literature of the world literally at my fingertips, but how would a student who could not drive and did not have access to private transport, study an animal living in about 1000km of a 3000km river often well away from major roads?

After a bit of research I found there was a gas exploration company working in Sindh called Lasmo, with its Head Office in the UK, so a carefully drafted letter and follow up phone calls extolling the virtues accruing to the company for appearing green and my job was done. I relayed my success to Pakistan, told the student that if he went to a certain address in Karachi he would be supplied with a truck, driver and armed guard (the latter to protect the vehicle with his Kalashnikov) for two weeks per month for one year, time to survey and sample over the desired length of river. This is one of the few times in my life when I felt I was being held, at least by those in Pakistan, as the performer of miracles – how can a man from thousands of miles away magically make a Toyota four wheel

drive truck appear from seemingly nowhere? The downside was that I was inundated over the next few years with requests to work my magic for other students from Sindh, usually to find them places in the UK.

In 1999 I was invited to visit this student at the University of Sindh at Jamshoro, an hour's drive north of Karachi and see where and how he worked, and whilst I was there take in the South Asia River Dolphin Workshop in Lahore in the more northern state of Punjab. Having traveled quite widely I had no great worries about the journey – my usual flight from Cardiff to Amsterdam then a direct KLM flight to Karachi. I had, however, never visited anywhere quite like this before and I was in for a culture shock.

The plane arrived in the early hours of the morning and I was met by my hosts and taken for a very early coffee in one of the large city centre hotels. Karachi is one of the world's largest cities and I was heading for its centre, and even at 3a.m. in the morning traffic was busy. My first real introduction to the reality of life in Sindh, the southernmost province of Pakistan, was, as we approached a five way intersection controlled by traffic lights, to be greeted by a cacophony of car horns as no-one took any notice of the traffic lights, every car for itself and even at this unearthly hour there were three, legless beggars moving around on their hands, begging between the cars – I realized for certain I was no longer in Britain. As we drove towards our cups of coffee in an ultra-modern hotel, the hospital on my left, I was told, was one of the best in Asia, "Have you or your family ever been treated there?" I naively asked "No, it is almost exclusively occupied by rich people from the Gulf States – and by the way, that is the wall where one of the Bhuto family was assassinated".

I had arrived in Pakistan but my luggage was elsewhere, and without another KLM flight for several days my hosts kindly took me back in to the city the day after my arrival to get a few clothes to keep me going. With trousers, shirts and underclothes in my shopping bag I thought I was fine, but no, I needed, I was

told, to dress like a Pakistani, to really enjoy the experience of my visit. I was measured, as if for a suit, and told my shalwar kameez (long shirt and pajama-like trousers) would be ready in the morning. As we emerged from the tailors on to the street, we were surrounded by beggars, women in burkas and bare footed men with little more than singlet and shorts. I was instructed to ignore them and, as I had no money, there was little I could have given them, but when I asked where these people were from, or what provision was made for them, I received a quizzical expression as an initial reply then “They live where you see them on the streets, they own only the clothes they wear, and if they do not beg they will die”. That is real poverty, that is culture shock and I was to see more of it as time went by.

After arrival in Karachi I was taken an hour or so along the Pakistan Super Highway, over a thousand miles of motorway throughout the length of the country, linking the Khyber Pass in the mountains of the north, to the city and port of Karachi in the extreme south. As far as I could work it out, as literacy is low, you do not need a test for a licence to drive trucks in Pakistan and the trucks there are big, overloaded and works of art, each individually and meticulously painted. The main object, it seemed, was to get from north to south along this endless stretch of road in as short a time as possible. Evidently the “best” way to do this was not to take breaks but to drive continuously with the aid of drugs. The outcome – upturned lorries on the roadside every mile or so, plus the occasional wrecked bus, all evidence of when the effect of the pills worked off! One thing I did find disconcerting about this road was the fact that donkey and camel carts often loaded high with sacks of cotton or loads of bricks appeared walking towards us in the fast lane of the motorway even at night and with no lights!

A second disconcerting event related to this road happened some days later when we were leaving the University of Sindh heading, somewhat late, for Karachi airport. The driver of our university car told us not to worry as he could easily catch up ten minutes or so – and so he did, as we drove up the off ramp of

the superhighway, across the track of oncoming vehicles then bumped over the central reservation in to our correct lane – ten minutes saved, and a close shave with heaven. The ordinary roads were an experience in themselves. I never noticed any road cones, but if a dead branch of a bush was in the road ahead, beware, as the road had almost certainly fallen away and a chasm lay behind the sprig of vegetation. In spite of travelling throughout Sindh with six armed police guards, my hosts would never allow me to travel after dark, or venture on to the roads by night themselves, as the main roads were frequented, I was told, by bandits and foreigners were rich pickings.

Although, as I guess in any institution, there are “interesting goings on”, even in Cardiff, but in Sindh, the university was a different world. My visitor accommodation within the university was comfortable, although electricity rota cuts meant air conditioning and lighting would be lost often for several hours a day in a country where a hot day can mean temperatures around 50°C. The building was surrounded by a 5m high wall, solid gates and my six Kalashnikov-armed police guards waiting outside. Opposite my accommodation was the female hall of residence, again with a permanent armed guard outside and should you visit the Chancellor’s office, on the chair outside the door was yet another assault rifle carrying guard. I later learned why the latter needed this protection. I was about to give a plenary lecture to all the staff in the Faculty of Science and was introduced personally to many of them. One was a female Senior Lecturer “Do you know how she got promotion?” I was asked. This rhetorical question was followed by the explanation that her husband used a pretext to see the Chancellor, then held a knife to his throat and insisted his wife would get promotion or the Chancellor would be killed. She became a Senior Lecturer! Then I met a lecturer in zoology “He is very popular with the students” I was told “Because he is a good teacher?” I asked, “No not really, he meets them before the module, he tells them he is not that interested in the subject and neither will they be, so he suggests that there is little point in giving the lectures

but he will give them all passes in the exam.” “Do the authorities know this goes on?” “Yes of course” – this is Pakistan.

I visited one of the Departmental professors. Outside his office a middle-aged man was waiting to carry his boss’s brief case, lecture notes etc wherever needed and when I said I needed a pee this man was called upon to go into the small squat toilet cubicle with me with a jug of water and a towel – it just doesn’t happen in Cardiff, perhaps because we have running water!. The research labs were very basic having very little more equipment than in the sixth form chemistry lab in the secondary school in which I taught. Sorry, that is not quite true, they did have a modern electron microscope, but it hadn’t been used, as no-one knew how to use it. The incubators in the microbiology lab, unlike in the UK, were used to keep incubation temperatures **down** to the mid 30⁰Cs. The university was meant to teach through the medium of English but that deterred some students so it was rarely used, but most students understood and spoke the language quite well. I was asked to give some lectures to the final year students on various ecological topics giving them the opportunity afterwards to question me about the subject. Almost always the questions came back to AIDS and, because of this, how dangerous it must be to live in Britain and were we sure the disease could not be transmitted by mosquitoes.

Certainly mosquitoes were an ever present accompaniment in Pakistan, from sitting with my hosts having an outside meal at a sporting club (the original Gymkhana) surrounded by smoldering mosquito coils which eventually burnt out and allowed the waiting insects in, to drifting in a small boat at sunset on a shimmering, golden, River Indus, and, as the sun set, the insects awoke breaking the effect of the idyllic scene. Through the clouds of biters, it became clear that the “shimmer” on the sunset-gold water was a layer of floating human faeces from the shoreline stilted houses whose toilets were the sack-draped ends of the elevated house platforms each with a long drop in to the river – plus of course a significant contribution of the effectively untreated sewage of the 150 million

people who live along the Indus valley. I also must not forget the mosquitoes at Karachi airport which make a long wait for a plane an experience somewhat akin to torture.

The culture shock extends beyond poverty to the very structure of society. Wherever you go you see men but no women. In a family home, after an excellent meal, I asked my host if I could thank his wife for her cuisine, he would pass the message on to her he told me, as a woman in this culture should not be seen. I had been told not to attempt to shake hands with a woman and indeed several men with whom I spoke said openly that they would kill their wives (each had three or four) if they were to even look at another man. A figure of speech I thought, but no, the means of disfiguration or death was usually boiling fat.

In an up market restaurant in Karachi, I was dining with three of my hosts, when in came three, twenty something young women, dressed in colourful saris and headscarves with uncovered faces, to me, looking smart but certainly not provocative. One of my hosts expressed dismay at seeing them as no wife of his would ever be allowed out on her own with other women and, even with her husband, never without the full covering of the burka. In contrast, in Lahore in Punjab, the young female staff of the World Wildlife Fund who managed the Dolphin Workshop dressed smartly but modestly with headscarves and aroused no animosity. The invitation to bring my wife on my next visit was politely declined.

While in the south of the country I got the chance to see some of the wild and human life. One day I was invited to go out on a traditional Arabian Dhow to look for oceanic dolphins in the Arabian Sea. With my armed police guard we headed out through the city and on this occasion they took the lead putting on their sirens and blue flashing lights to speed up our journey, making me feel quite important in the process. One aspect of my student's Indus river dolphin study was to evaluate how polluted were the sewage inflows to the Indus, so we diverted deep

into the Karachi slums to the point where much of the city's liquid waste enters the river. Certainly the sewage had its strong and expected smell but the area itself with shanty homes and no amenities also had a unique smell, difficult to describe, pungent, but not as totally heart rending as the poverty which created it. For the equivalent of about 2p a young boy was sent to stand in the river-like outflow of untreated sewage and collect a bottle full for analysis – I wasn't shown the risk assessment! - and pre-teenage youngsters came up to see what was happening, "Why are they so interested in us" I asked, "They have never seen a policeman let alone a European before" and as if to confirm this, first one, then several came to touch my skin which probably looked corpse white to them, to see if I were real – an experience which happened several more times in remote areas over the next few weeks – I must have been a scarce commodity, as I never saw another European in my time in Sindh, even in a city of 12 – 15 million people.

The police left us as we drove on to find the docks from where we would board our Dhow. As we followed up the coast with the river estuary to our right, droves of six metre long canoe-like craft were making their way homeward piled high with fish, the entire interior of the craft filled to a metre above the craft's sides with fish each no longer than about 10cm. We entered a zone where, for two to three kilometres, either side of the road, extending back for several hundred metres, there was nothing but drying small fish, and occasional dogs making the most of the free fishy treats. If I thought the previous location smelled then this "world of fish" could beat anything. Why were all these undersized fish being caught and dried – fish meal to feed this country's ever growing flock of chickens was the answer. I doubt if the word sustainability would translate well in this part of the world.

We arrived at the dock to await the Dhow minus our police escort. After a few minutes the three university staff who accompanied me were detained by the harbour police for an hour or so by which time our vessel had arrived. "What was

the problem” I asked, “Since the murdered American’s head was found last week authorities are on high alert for foreigners being abducted, and we, with you, looked very suspicious, but now we have convinced them” I was told. So now we got on to the boat to sail away for seven or eight hours to look for dolphins. The ship’s crew, especially the younger boys, wanted to try out their English, so we had conversations about how their country liked the English as they had created the country’s infrastructure of river barrages, railways etc which still help the Pakistan economy, but they hated the Americans for their aggressive, imperialistic ways, and they joked that I should have a T shirt inscribed “I am not an American” which, they assured me, would keep me perfectly safe. The Dhow had an open deck with an area shaded for me with a tent-like carpet and to the rear of the boat you stepped down to a wooden bar above the open water for all your very public toilet needs. The crew line-caught a bucket full of fish and the ship’s cook cleaned and fried them. I will probably never eat fresher, or better tasting, fish than these. As the day wore on the crew brought out their mats and said their prayers and I wondered if they included a prayer to see dolphins as we had now been heading out into the Arabian Sea for almost five hours without the sight of a single cetacean. I asked my hosts if this was the expected outcome of the trip to which they replied “Yes”. Evidently at one time, just a few years previously, dolphins could be seen from the shore, but today, expect to be at least five hours out to sea before any might be found. There are probably at least two reasons for this, one is the inshore over fishing of undersized fish which we had already observed, and the other was that, as fish got scarcer, dolphins were and continued to be, routinely shot to remove competitors for the remaining stock. After five hours we did see one dolphin and then we headed home after an interesting if not very productive day.

The following evening we had the opportunity to again cross central Karachi at speed by allowing our police escort to lead, sirens screaming and blue lights flashing, heading for the coast and a loggerhead turtle breeding beach. I was informed that the lady who ran the project, almost unsupported, would ask me to

look for external funds to help this worthwhile scheme, but probably best if I didn't help I was told, as, although she was very pleasant, she was a Punjabi and so, in the eyes, of people from Sindh, could not be trusted! We arrived well before nightfall and decided to spend an hour or so exploring several kilometres of the shoreline and in that time found the decaying bodies of thirteen dolphins some with clear gunshot wounds, which, if multiplied by the hundreds of kilometres of Arabian Sea foreshore, would easily explain our almost fruitless search for dolphins the previous day. As evening turned to darkness the shoreline waves became visible for hundreds of metres in either direction as a bright luminescent green zone of glowing plankton. As we waited for our first turtle, we were allowed to release some of today's hatchlings back to the ocean. They were tipped gently on to the sand and, as if on clockwork legs, they flip-flapped their rapid way to the ocean and turtle life. Just after midnight our first turtle was found lumbering up the beach leaving its ladder-like track in the sand and then proceeded to excavate its nesting hole. After an hour or so the eggs were laid and covered and the old female turtle began her lumbering return to the sea. By the time she entered the water the conservation team had collected all the eggs and reburied them inside the scheme's compound where they would be safe from human and animal predators which elsewhere along this shore take a heavy toll on nesting turtles and their eggs.

Another day we headed inland and east towards the border with India, to a large reservoir/lake, nature reserve and research facility for rarer wildlife. The research base was a medium large, brick built, rectangular building, perched at the edge of a lotus filled lake, separated from it by a one metre wide concrete perimeter path at lake level. Some distance away I was taken to the enclosures where the research station was breeding some "rare" ducks, which, unless something got lost in translation, I would have sworn were mallards! I then took a few minutes to explore the area myself and there in the trees was a water deer, new to my species list. I then ventured round the concrete path of the building towards the lake, binoculars in hand, to see if there was any other wildlife in or around the

pink flowered sacred lotus beds. I turned the final corner of the building to be alongside the lake and there no more than two metres ahead of me was a basking, three metre long crocodile, too close for comfort and very surprised to see me. It opened wide its jaws and with an almighty hiss (fortunately) dived back in to the lake. I stood still and watched as the big body moved silently just below the surface, gently bending the lily-like leaves of the lotus, until it finally stopped some four or five metres out, and, if I had not been closely following its progress, I would never have spotted the two eyes now turned towards me – and the students at Jamshoro had the temerity to tell me that the UK was a dangerous place because of its mosquitoes!

It was now time for me to explore the Indus Valley itself, firstly being reminded that this valley was, some 4,600 years ago, when Britain was still in the Stone Age, one of the cradles of civilisation. This was contemporaneous with ancient Egypt and Mesopotamia, and now in Sindh only the ruins of Moenjodaro remain, then a great city of 40,000 people and now, in an arid 40+ °C landscape and in danger of decay, the Pakistani equivalent of Stonehenge, but with hardly any visitors and poor preservation, a sad reflection on a great legacy of history.

In Lahore I visited several important mosques including the Badshahi or Imperial Mosque which was once the largest, but now the fifth largest in the world, with a prayer hall to hold 55,000 and an enclosed courtyard, still the largest in the world, big enough for 95,000 people to pray together. Without exception the architecture and workmanship was stunning, lace-like windows carved from solid stone and blue and white elaborate decoration. Also in Lahore I visited the impressive Lahore Fort or Shahi Qila, approached up the majestic steps of the Elephant Gate and elsewhere at the other end of the visitor experience I was taken to join the crowds watching mongooses kill unfortunate snakes in the name of entertainment.

One thing I discovered about all the every day Pakistani people was their kindness and generosity, they will always feed the visitor before themselves. A cup of char is the first offering, a small cup of tea sweetened usually with condensed milk, not fully to my taste but a non-refuseable sign of welcome. A house meal can take on gigantic proportions and often includes fish. I thought the idea of fish in a hot climate was somewhat a contradiction of logic, but the markets usually obtain and sell the fish still alive so its freshness is guaranteed. In some areas I was warned to avoid the fish as the locals used widely banned insecticides, such as DDT, to scatter on the water and bring the (now contaminated) fish to the surface, indeed one river dolphin carcass we analysed was so contaminated with DDT that it would have been classified as hazardous waste in Britain.

The British, as I have said, are, or were when I was there, widely admired in Pakistan for providing much of the existing infrastructure including river barrages and railways which still drive the country's economy. The Indus and some of its tributaries are barriered by a series of low dams or barrages which divert water into 50,000km of irrigation canals and channels. This is great for agriculture but not always as good for wildlife. When I visited in the dry season there was no water from this mighty river flowing from the final barrage to the sea. This has effectively destroyed an important artisan fishery and food source because the hilsa, a migratory fish, can no longer effectively get to or from the sea. This species, a relative of the herring, typical of the lower reaches of many Asian rivers, is a popular food in much of Southern Asia and said by some to be the best tasting fish in the world. I was introduced to a single roadside cooked hilsa stall, the remnant of a once thriving industry.

Upstream, the river behind barrages and its general course when in flood can be several kilometres wide, but the barrages are barriers not only to fish but also to the Indus river dolphin, breaking the population into sub-groups which now rarely mix genetically. The Indus river dolphin, and its close relative the Ganges river dolphin, from which it was separated millennia ago when the tributaries of both

rivers were redistributed as a result of geophysical change in their Tibetan Plateau headwaters, are two of very few truly freshwater cetaceans many of which are endangered or, as in the case of the Yangtze river dolphin in China, now extinct due to dams and pollution. The Indus River is constantly turbid so that the dolphins have evolved to navigate and search out fish as prey by sonar. In a lightless world, sight has become a largely unused sense for these creatures and in consequence they are often known as blind river dolphins although in truth they still have functional, if reduced eyes.

Today there are perhaps little more than a thousand of these animals in existence, much reduced from the days when the Indus was a clean, free flowing river. Long used by the local fishermen for food and lamp oil and as the basis for many legends, their scarcity has resulted in their legal protection and international conservation interest. This sounds a good, simple and obvious partial solution to the dolphin's decline, but few things in life are so simple. The animal has had to contend with its habitat and populations being fragmented by barrages across the river; by thousands of kilometres of often seasonally flowing irrigation canals in which the animals get trapped; by the pollution of domestic, industrial and agricultural waste entering the river which kills fish and harms dolphins; by increasing human population pressure resulting in more fishermen chasing declining fish stocks, resulting in less dolphin food and more dolphins as by-catch and last but not least by the difficulty of communicating the value of protection laws to illiterate fishermen living in remote riverside villages.

This final element was one I had not really thought about before I came to this part of the world. I was staying in a five star hotel in Lahore in Punjab, a building being used while I was there by leading members of the Pakistani government and other high ranking governmental officials, necessitating discreet armed guards on each intersection of each floor. Amid this high security hotel life went on; lavish weddings measured in days not hours sang and danced their way across the pristine, parrot bedecked lawns and over-attentive staff annoyed me,

as that “home made” ice-cream, bought from “a famous” shop in Hyderabad, had given me diarrhea which did not initially respond to treatment and would bother me on and off for the next six weeks, made me less than good company. Feeling a little safer that I could move further from my bathroom, I ventured out on to the balcony of the central atrium, which was the heart of the hotel, to see ten, very tall, armed tribesmen in traditional dress carrying metre long swords sweep through the entrance doors towards reception. With all the governmental VIPs around, the security guards looked concerned in case of trouble. They did not need to be concerned as these warriors were actually part of a company of singers and dancers who had come to see us dolphin people to demonstrate how they interact with the local tribes of fisher-folk. In traditional culture, information and traditions can best be communicated through song and dance as these river people are illiterate and without access to written or broadcast media. For an hour we were entertained by these traveling musicians and dancers telling stories (we were told) of the legends of how the dolphin came to be and why they should play their part in protecting rather than killing it. This approach was said to be extremely effective.

A few days after the conference we were back in Sindh and, with the Sindh Wildlife Service, had been sent to supervise the rescue of a dolphin from an irrigation canal for release back in to the main River Indus. The location was very remote and men and children of the local fishing village had assembled canal-side in the 40°+ C heat to watch proceedings. Long seine-like nets were set across this 100m wide waterway and slowly the nets were brought together until the metre-long, pale grey dolphin was caught and temporarily tethered around the base of its beak-like, sharp-tooth encrusted lower jaw, to await transportation back to the river, wrapped in muslin cloth and irrigated with cool water. Before its journey it was subjected to a few minutes of indignity of being touched by the villagers and children who discovered for the first time, contrary to local myth, that these were not fierce animals to be killed because they might attack humans

with their sharp teeth, but harmless docile creatures with whom they could share their watery workplace or playground. Animal saved and a village educated!

Of the other threats to the dolphin the only one I felt I could contribute to was that of pollution of the river by all the wastes of a nation. Having a long-standing interest in bioremediation, I felt that the river would be almost ideal to have natural vegetation filter systems developed parallel to the river bank and through which effluent could be directed to be partially decontaminated before it entered the river, at the same time producing a useful coppiceable crop of fuel, and a haven for wildlife. Also, having been involved with Ark sites in Britain where vulnerable species can be kept safe from lethal threats, I suggested that some rescued dolphins might be released in the lake where I nearly “smiled at a crocodile” which would then become an Ark site in its own right. I do not think that either of my suggestions were ever taken up in Pakistan, but a few years after the Lahore workshop I saw an article about the Ganges dolphin, by a delegate at Lahore, saying that lateral biofiltration beds on the Ganges had become a reality and made me think, was it just coincidence or had my message achieved its goal?

I can best sum up my hopes for the Indus and its blind dolphin, the river people and their fisheries and the country as a whole, by wishing that one day the Indus valley may be safe enough and, with sufficient infrastructure, for foreign visitors (even Americans!) with lots of money to visit, not just to see the neglected historical sites of world significance, but to pay the local fishermen well enough to go out on boats to watch for this gem of an animal so that they realize that dolphins are a better source of income alive than dead.

5. In Lands of Change – Majorca and Cape Verde

I have travelled to many countries for many different reasons but two places stand out for the frighteningly fast transition from a rural economy to the fast lane of the twenty-first century, some rural parts of Majorca and the Cape Verde Islands, first visited a decade or so ago have made this transition a lightening speed. Like many rarely seen old friends whom memory recalls as they were in their youth, so also for places seen before their natural beauty faded and before the false make up of development was applied to mask the scars of “progress”. For both countries I look at how they were when I first knew them, and reflect on what the future might hold.

The Changing Majorcan Spring

As a gunshot rang out from the other side of the high garden wall somewhere near the old, tree-high, prickly pear, but, fifty metres away In the Aleppo pine wood, I continued to watch fascinated, the line of processionary moth caterpillars as they crossed the woodland floor, in single nose to tail file, to find a suitable terrestrial spot in which to pupate. A minute or so later the landowner turned the corner of the adjacent walled garden and greeted me with a friendly “Hola!” carrying a shotgun under his right arm and a dead chicken by its neck in his left hand. My countryside experience in the UK was of domestic chickens running up to greet anyone who might feed them and were consequently relatively easy to catch. Clearly here on Majorca, farm hens were more or less feral and kept safe from foxes by roosting amongst the spines of the prickly pear and the only way of getting chicken for dinner had been demonstrated by the farmer.

I was here because, behind the high rise, sun-seeking, seaside fringe, the real Majorca still existed, but this traditional farm with its almond and carob orchards was ear-marked for a development called Parc Bit, designed by architect Lord Richard Rogers to allow 3000 “compute from home” workers from all over

Europe and their associated high tech businesses, to locate in this area close to Palma. The job involved visits in February and May to evaluate the ecological richness of the site and suggest ways to mitigate the inevitable destruction of the countryside. It was time to do my work but also to soak up the atmosphere of this timeless but time limited world.

In the UK it is not just the chickens that will check out humans but fearless robins follow the fork as the garden is cleared. Here in the Mediterranean the winter woodlands are well stocked with robins but these are shy retiring birds which we only really saw when they flew into our mist nets set up for the very purpose of recording even the most elusive of flying wildlife. When we returned some months later the robins were gone, heading north, as was the wintering flock of stone curlew which we had earlier watched each sunset as they circled in as silhouettes amongst the carob and almond tree-studded corn stubble almost always accompanied by the monotonous call of the scops owl and we thought, in their ears, might soon be replaced by the tawny owls of eastern England.

Sitting on part of the old walled garden wall, now in some disrepair, but still a useful vantage point over the almond and carob fields, I look and listen to an unfamiliar rural landscape. The chickens, now depleted in number by at least one, scratch amongst the litter of straw bales and are joined by a dozen or so Majorcan black pigs with characteristic neck tassels earlier free ranging in the carob fields but no doubt with the freedom to take their share of the acorn harvest at the appropriate times of year, before becoming the famous sobrasada sausage.

Living as I do in a part of Britain with more sheep than people, a sound of spring is the contact bleating of ewes and lambs, but here, a few miles from Palma the same sound has the accompaniment of sheep bells, as the itinerant flock and its shepherd removes the aftermath from the harvested fields as if nothing had changed from biblical times. Although in a different context, chickens, pigs and

sheep are familiar sounds to me but, in this rather dry landscape the rasp of calling amphibians was not immediately expected, so I left my seat on the old garden wall to track down this sound which seemed to come from everywhere but nowhere and due diligence took me to a large rectangular water tank waist high off the ground but full of song until I looked over the edge to find just silence and the swirling water of frogs diving for safety. I went back to my half collapsed wall to look and listen and, for no good reason other than it was there, I began to peel back the mat of vegetation which covered the wall, there to discover a secondary mat of almond stones each with a hole reminiscent of hazel dormouse-eaten hazel nuts back at home, but here I had found the unmistakable stash of the continental garden dormouse which I had not seen but which were clearly there.

Some time earlier I had told the farmer that I had seen a tortoise crossing a trackway, "very lucky", I was told as since the advent of tractors to till the land they had gone the way of hedgehogs in Britain in becoming flattened fauna. Some things clearly were already changing, but little compared to the transformation which was about to occur in the name of progress.

But for the time being things were still much as they always were and, as I hunted the native flora along field edges, along came a local carrying a trug-like basket over his arm, evidently looking for the same thing as me – or at least in part – as I had recorded three species of wild asparagus and he was there to collect the same "Try some" is what I hope he said in Spanish – I tried, and the youngest tender shoots tasted of fresh peas, as good, I reluctantly admit, as my home grown asparagus crop - another land, another countryside.

On this large but traditionally managed farm, which long ago adopted the concepts of agro forestry, where crops are grown between the olive, almond, carob and fig trees, spring comes particularly early in British eyes. At the turn of the year, bird activity is at its minimum and where the farmland retains the last of

the winter rains, finch flocks gather at watering places where the old Moorish field drains have broken with the passage of time and offer an ornithological diversion to the winter landscape. Although some winter migrants remain for a few months yet, by early February the flocks of itinerant finches will have already flown north.

This new season is heralded first, in a subdued way, by the fruits of the ancient, evergreen carob trees emerging as bright green fingers from the old warted stems. It is, however, the pink of the almond orchards in full blossom which most catches the eye, especially when, as often happens, Bermuda buttercup, the yellow flowered relative of our own wood sorrel, carpets the ground beneath the trees. Many of the orchards will have been ploughed in August and September after the carob and almond harvest to be undersown in October mainly with barley, but also with small areas of wheat and oats and some beans to be harvested mainly as pig fodder. Although most of the barley will have been grazed by sheep, the remainder, now in February, is a metre high and will be grown on to harvest. Cereals grown to harvest are threshed for seed for the following year.

On some orchards which have been more recently ploughed, the migratory population of stone curlews will have overwintered with the year round resident birds. These birds are most evident at dusk when their distinctive and incisive calls indicate that they are on the move around the whole farm area. Dusk is also the time when bats, often in this area Khul's pipistrelle, leave the crevices in the old finca walls. Other larger bats are also about, probably serotine and long-eared. Although the bats are largely silent to our ears, scops owls on the farm's periphery add to the sounds of the Majorcan night.

Stone curlews are as difficult to see in flocks as are resident pairs breeding on the same fields later in the season. Occasionally, in the day, a silent, low flying group of these birds may drift by to disappear into an apparently empty field. On this farm the maximum flock seen during the day was seventeen birds flying

silently about a metre above the ground fringing an area of widely spaced carob and coming to rest invisibly in ankle-high grass.

Perhaps the most characteristic sound of the traditional Majorcan countryside is that of distant sheep bells accompanied by the bleating of their wearers. On this farm, to graze the pastures and clear areas after cropping was an itinerant flock of some 400 sheep with its ever-present shepherd. In the mornings the flock would graze some abandoned farmland of old Carob trees now overgrown by maquis scrub. In the afternoons the sheep were moved to the barley fields and permanent pastures.

In the fields around the farm, black sows and piglets, some eighty in all, with natural black tassels hanging from their necks, scoured the permanent pastures for whatever may take a pig's fancy. In the past they were allowed to forage for holme oak acorns in what has become an environmentally protected area. Closer to the farm a variety of free-range chickens, turkeys and Guinea fowl scavenged around the straw stack, and, in the evening, a cacophony of sound as the half feral chickens flew up to roost in the old fig trees and prickly pears in the outer courtyard. This outer courtyard protected, by a hedge of prickly pear cactus, is part of the almost castle-like farmhouse or finca built several centuries ago which itself faces in on a cobbled inner courtyard and protected from intruders by enormous ancient wooden doors set in the entrance arch. In the centre of this courtyard is a well, shaded by a date palm and to the sides bougainvillea grows over trellis work keeping the summer sun off the flight cage of canaries. The house itself is entered through a door tall enough for a giant to pass through unbowed. Beyond this the rooms are very lofty with cool, stone-flagged floors and a décor clean, but in keeping with their age.

Spring on the floor of the Aleppo pine woods, retained as stock shelter on the rocky soils to the rear of the farmhouse, is marked by metre-long processions – nose to tail if they had them – of the introduced processionary moth, a pest of

these trees, which first hang within a silken fist-sized nest, spun by the caterpillars for protection before they finally descend in line to pupate within the forest floor. Also on the woodland floor in February are several species of early flowering orchids including the mirror and brown bee orchid, a group of plants for which the island is well known. It is at this time of year, as I had already found, that local villagers can be found hunting the field margins for new shoots of any of the three species of wild asparagus which abound there.

In addition to resident birds such as hoopoe, Sardinian warbler and serin, the last two of which were holding territory, if not breeding, in February, the woodland also contained winter visitors such as the skittish robins and black redstarts destined to stay for only a few weeks more. In the more open habitats white and grey wagtails, skylark, song thrush and meadow pipit would soon also migrate north.

In the open rocky areas two species of asphodel were in full bloom, white flowered invaders of abandoned land. On the rocky outcrops where these plants occur were the occasional droppings or spraint of the pine marten. The genet, a wild, cat-like relative of the mongoose, feeding on small mammals and reptiles, is reputedly here too but rarely seen. Stoats and hedgehogs, rabbits and hares are relatively common animals of the fields and ubiquitous rats scavenge around the farm. Evidence of one common small mammal has already been described, the garden dormouse, where a section of stone wall had collapsed and its covering of bramble has been pulled away.

Although the farm crops are traditional some of the farming methods are becoming modernised. Limited amounts of modern artificial fertilizers, but almost no pesticides are used, making the farm, almost by default, an organic unit. The old farmer reflected back to the pre-tractor days when tortoises were frequently seen before they became victims of machinery. Other reptiles are still on site including Moorish geckos and other lizards which are common on walls together

with two snakes, the false smooth snake and, in wetter areas around the “Torrent”, a seasonal stream which cuts down from the hills, the viperine snake.

With the ever present backdrop of the Sierra da Tramuntana, the mountainous northern fringe of the island, it is evident that some species seem to be surviving against the odds. Red kite and peregrine/Elanora's falcons pass overhead several times a day and binoculars pick up booted eagles with some regularity, even though we are only a few kilometres north of Palma.

Within the orchards the aptly names fan-tailed warblers and ever present Sardinian warblers and ciril buntings are active amongst the trees and theckla larks move almost invisibly amongst the broken ground. Within the scrub along the almost-dry stream bed of the “Torrent”, Cetti's warblers are heard rather than seen, whereas in the fringing poplars, serins are to be both seen and heard. Even in February swallows are steadily moving north, but this is predominantly the time when winter visitors begin to vacate their winter territory before most of the summer migrants pass through in the next couple of months.

Turning the calendar from February to early May, the almond trees are now green with leaves and Bermuda buttercup has given way to a thistle-dominated sward. Some of the cultivated fields, especially the beans, are now a mixture of yellow crown daisy and the red of the common poppy. Elsewhere, on rocky outcrops and stony field edges, often dominated by a scrub of common myrtle, mastic, the olive-like leaves of *Phillyrea* bushes all intertwined with smilax, appear the flowers of early summer including the diminutive and oddly shaped friar's cowl, the reddish-purple wild gladiolus, the spectacular, mainly white *Ornithogallum arabicum*, *Nigella* or love in a mist and the pink of rose garlic. Lacking aesthetic beauty but possessing a child-like fascination, squirting cucumber grows amongst the track side weeds ready to shoot out its seed at the gentlest touch.

By now the flocks of stone curlew have gone leaving only the resident breeding pairs. The ever present hoopoe, circl bunting, linnet, great and blue tits, Sardinian, Cetti and fan-tailed warblers, stonechat, wryneck, red-legged partridge and theckla larks, are now joined in the fields and woods by an itinerant band of passage migrants including turtle dove, pied flycatcher, redstart, cuckoo, golden orioles and willow warblers. Arriving for the summer, swifts, house and sand martins circle high overhead, bee-eaters, a dozen at a time, line up on power cables which cross the fields and woodchat shrikes and nightingales move silently and elusively from carob tree to carob tree. Perhaps the most obvious ornithological change is that the nest-bound house sparrows of February now noisily seem to fill every tree around the farm with their recently fledged broods.

Even away from the mountains and within distant earshot of Palma, a blue rock thrush makes a sortie from holm oak on some uncultivated hillside, to the Aleppo pine plantation. This unfarmed patch, now frequented by young lads on motorbikes, was deserted in February except on its bare south facing slope where hundreds of bumble-bee sized, solitary bees were digging holes in which to lay their eggs watched by slightly smaller, parasitic bees with checker board markings ready to dive in to a nest hole to lay their eggs as soon as the rightful owner emerged.

Particularly around asphodel flowers butterflies were quite common, some spectacular like the swallowtail, others more mundane like the small white, brimstone, speckled wood and red admiral. The day-flying hummingbird hawkmoth, a ubiquitous Mediterranean species with an enormously long, nectar-sipping tongue, also appeared from time to time seeking out flowers along the "Torrent". Near the "Torrent" the farm had an old mechanical bucket system for lifting water from a shallow well into a series of concrete tanks as part of an irrigation system. An audible difference on the farm between late February and early May was the rasping call of the green frogs within these tanks. They were

present but almost silent in February, but audible at 200m, let alone my nearer dormouse infested garden wall, in May!

Time moves on and as Majorca slowly bakes in the summer sun, the countryside dies to a quiet crispness to await the autumn harvest and the cycle of the seasons to go full circle. The seemingly timelessness of sowing and harvest, in a landscape in tune with nature, gives reassuring stability to the rural island life.

Sad therefore, that if I were to write of this same area today, I would be describing effectively a suburb of Palma, where the maquis scrub is only seen as cistus dominated decoration as signature landscape “flower” beds and the stone curlew as a video image on a web page in this new techno-village.

Deserts in the ocean: The case of the Cape Verde Islands.

To understand why I developed an interest in these islands, little known until recent years and still only known as largely all inclusive holiday options on two or three main islands, you need a smattering of Cape Verdean history, sociology and biology, only then can the archipelago’s opportunities and problems be seen in their true perspective.

To call all the islands of the Cape Verde archipelago deserts, is undoubtedly an exaggeration, but these once little known lands, some six hours flying time south from Britain have, in recent years, gained appeal to European holiday makers due to their generally sunny, arid, desert-like climates. When I first visited these islands in the early years of this century, few non-natives seemed to know of their existence and commercial tourism was almost restricted to a line of seafront hotels in one village, Santa Maria on the island of Sal. Ironically, this location had developed because of the apartheid regime in South Africa several decades ago. Then, in order to evade restrictions placed at that time on South African flights, a

long runway airport was built on Sal to service such planes, a legacy which subsequently allowed international tourists easy access. These islands are going through a period of rapid transition taking some of them from unspoilt to spoilt beauty. For those of you unfamiliar with this collection of nine inhabited and several smaller islands I will give you some background against which you can judge the pace and extent of change.

The Cape Verde islands lie at 16°N 24°W in the Atlantic Ocean, 1600km south of the Canary Islands, 500km west of Senegal and in the path of the Northeast Trade Winds. An archipelago of some nine major inhabited islands all of volcanic origin, the most westerly of which are often mountainous and reach a maximum height of 2829m on volcanically active Fogo, receiving moisture mainly as mist and cloud with rainfall in unpredictable quantity. The eastern islands of Sal, Boavista and Maio are geologically older, reaching no more than 600m and are generally arid, in part due to the lack of rain shadow effect, with desert like conditions and often-extensive saline areas. These harsh conditions have not only influenced the lives of the inhabitants but have also moulded the biogeography in a way not seen elsewhere in Macaronesia.

The islands, first discovered by the Portuguese around 1456 were then unpopulated, are now an ethnic mix of African and European blood, the balance varying from island to island. Santiago is the most African as a legacy of its role as a base for the transshipment of slaves from Africa to America. In the sixteenth century the Portuguese found the island sufficiently green to establish their first "city in the tropics". In 1747 the islands suffered the first of the many recorded droughts which have plagued them ever since. Over 100,000 people died in the three major droughts of the eighteenth and nineteenth centuries and thousands more in the droughts of the first half of the twentieth century. Even though there was more rain in the mid to late 1980s which helped agriculture, this followed a drought of almost twenty years and since the late 1990s a further drought began continuing into the next decade. Today more Cape Verdians live outside the

republic than within it. In the nineteenth century the whaling industry around the islands took many Cape Verdians as emigrants to New England and at the end of that century the use of the islands as a site for steam ships to replenish coal, water and food, created more long distance connections to draw islanders away from their Atlantic home. Much of this coal came from the mines of Wales and I was introduced in Mindelo to an old man who worked in the island's offices of the Cory mines, a major Welsh supplier of coal to the steam ships of the world.

Today the islands are still poor, and the 70% of the population, which lives in rural areas, share only 11% of the Gross Domestic Product (GDP) in the agricultural sector. 82% of food is imported and 60% of food imports are as food aid. In the early twenty-first century it remained one of the 25 poorest countries in the world with over 30% earning below the poverty line of \$1 per day and 21% unemployed with 20% of GDP provided by remittances from expatriates. This socio-economic base has had a major influence on the biogeography/biodiversity of the islands. The combination of agricultural poverty and drought through the last four centuries has resulted in a continued ravaging of the natural vegetation by people and their goats which are left to feed on ever-decreasing resources. Other introduced animals such as rats, cats and green monkeys, combined with human exploitation of sea birds, and sea life contributed to a continued depletion of biodiversity.

The Endemic Baseline

The geological history of these volcanic oceanic islands is still subject to debate but the flatter eastern islands of Boavista and Sal have been estimated to be up to 26 million years old, Maio and São Nicalau perhaps half that age and still volcanically active, Fogo, last erupting in 2014 with its small neighbour Brava, date back perhaps 100,000 years. This spectrum of time has provided the opportunity for evolution to produce a range of island specific endemics. For those familiar with other areas of Macaronesia such as the Canaries and its *Aeonium* plants, or the rich endemic flora of the Azores, the endemic flora of the

Cape Verde islands appears sparse in comparison. Of a total of 621 species of higher plants on the Cape Verde islands, 85 species are endemic, a further 88 occur there naturally and the remainder are definite introductions or of unknown origin. Among the lower plants there are seven endemic lichen species amongst a flora of 320 and fifteen mosses out of 110 species, but the degree of endemism amongst the 39 liverworts and 32 fern species is not known.

Four species of land bird are endemic to the islands. The Cape Verde sparrow and the Cape Verde swift occur on at least nine of the ten main islands. The Cape Verde warbler is more restricted, occurring on Santiago and possibly Brava. The most restricted endemic is the Raso lark found only on the small arid islet of Raso. There are several other Cape Verdean birds for which there is debate over their specific status some regarding them as species others as subspecies and these include variously, a kite, buzzard, various falcons and an owl.

Amongst terrestrial invertebrates there are three endemic extra-marine snails (out of twelve known species); fifteen out of 37 freshwater/land snails; 46 out of 111 spiders and 155 out of 470 beetles. There are no indigenous land mammals but five bat species have so far been found: naked bellied tomb bat, Kuhl's pipistrelle, Savi's pipistrelle, grey long-eared bat and the long fingered bat. However, twelve of the fifteen species of terrestrial reptiles are endemic. They include the giant gecko found on Raso and Branco, three other species of the same genus plus five *Mabuya* skinks and three *Hemidactylus* lizards. The giant skink from the islets of Branco and Raso became extinct shortly prior to 1916. The small islet of Raso is home to both the endemic lark and giant gecko and it seems ironic that the latter rarity is said to be partial to the nestlings of the former, and this was a potential project in which Liz Chadwick and myself were keen to be involved but finances conspired against it, but it still reminds me of protected otters eating protected bats in the low mine adits of mid-Wales!

It is perhaps worthy of note that Charles Darwin visited Santiago in January 1832, made no records of note but remarked “how glorious it is to walk on volcanic rock, to hear the notes of unknown birds and to see new insects fluttering about still newer flowers”.

The Biogeographical Context

It has been suggested that on the higher and somewhat wetter islands the climate is suitable for the development of dry monsoon forest that was probably present in the past. Before human colonisation, the lower and drier islands probably had savannah or steppe vegetation merging to semi desert in the flatter inland areas with arid scrublands at higher altitudes. Most remaining natural vegetation is in steep ravines and on inaccessible ledges in the mountainous islands and a few patches on the flatter islands. On the northern side of Santo Antão the hills often appear green due to the growth of a trailing somewhat cylindrical stemmed succulent or the planted pines, oaks and sweet chestnuts, but elsewhere, such as in the uplands of Fogo, there are eucalyptus woods, and *Acacia* on islands such as Maio. Crops such as sugar cane are often planted in the tiniest and most precarious of soil pockets often to make the local variant of rum, grogue. Elsewhere, wherever crops will grow they will be planted. The sight of vines and other fruit trees growing in the apparent arid ash of the caldera of Fogo seems contrary to logic, but they do produce excellent wine. Very few native trees remain except for dragon trees (*Dracaena draco*) in places on São Nicolau and, the tamarisk palm best seen in the intermittent flood channels of the otherwise desert-like Boavista.

Thoughts in time

I put down these thoughts on the island of Sal at the end of a visit in the early 2000s and after addressing their government on my predictions for the spectre of uncontrolled, mass tourism and its consequences – predictions I fear time has proven to be true.

“My vantage point is the pier, looking out along the beach at the paraphernalia of modern beach tourism; bodies tanning on lines of sun beds, the sails of kite surfers moving angularly across the open bay, the continuous beat of pop music from the seafront-all inclusive-chalet-based-hotels, a frighteningly real ghost of the future for this archipelago in this Christmas escape land for the Portuguese. The pier, on the island of Sal, has, it seems forever, been the epitome of all that the small town of Santa Maria stands for. In the West, Health and Safety Regulations would ban its rotting, hole-ridden deck from being used, but here it has been, and is, the centre of the fishing industry, the leisure centre for the high diving village children and the starting point for diving, whale-watching and island hopping tourists. In its rustic utility the pier sums up the contradictions that are the Cape Verde Islands as it clings to the past but wants but cannot afford to ignore the future.

For those of you who ask, “where are the Cape Verde Islands?” the easy answer is “two hours flying time south of the Canaries”, but when you arrive and ask “where is the “Verde” in Cape Verde?” you have found another of the contradictions, for the islands have blue sea, white, gold and black sands, red and salt encrusted desert, but almost no verdant green. Almost, but not quite, for the westernmost of this archipelago of nine major islands, receive moisture from the northeast trade winds making Santa Antão one of the few islands with any, but few, permanent streams, feeding crops in the steep valleys between spectacular peaks.

Away from Sal yet another contradiction arises, in why should a nation borne here by the oceanic trade winds, fear the one hour ferry journey from Mindelo to the island of Santa Antão? We boarded the ferry, long retired from its first life as an Isle of Wight ferry, for today’s, almost flat calm, hour long ride over open ocean, among crowds of Cape Verdians who each carried a supermarket carrier bag. No sooner were we out of harbour than the vomiting began! The generous nature of the Cape Verdians was evident as they shared bags, which when suitably full were flung, hammer-like over our heads into the sea. Not everything

was bagged and, as the “tide” of vomit flowed back and forth, luggage was rapidly lifted from the deck. On arrival the entire ship was hosed before the repeat performance on the return trip. I do remember the beauty of the peaks and steep green valleys of this exceptional island but it is strange how anomalies in human behaviour tend to also stick in the mind! There is now a new Mindelo ferry, I wonder if old habits die hard?

The easternmost islands of Sal, Boavista and Maio are the oldest, flattest and driest and breeding grounds of one of the best loggerhead turtle populations in the world. Here again the ghosts of time still linger. Imagine twenty-five kilometres of pristine golden sand backed by low dunes and you are the only people there, it's not paradise, but the almost tourist free island of Maio. Turtles have ploughed their treaded tracks into these sands since before man was man, but in the not too distant past they and their eggs were a harvestable commodity in what is still, may I remind you, one of the twenty-five poorest countries in the world. The locals claim that many of the scattered, long-dead skeletons of turtles in these dunes met an unnatural end.

However, over the water on Boavista, I watched, by moonlight, the lumbering bulk of a tear-eyed loggerhead turtle moving up its traditional beach to dig and lay and return to the sea. Cape Verde one of the most important breeding sites for this species in the world and this island's eastern coastline is one of the best-studied loggerhead turtle nesting sites in the archipelago, where at least science shows its concern for these denizens of the deep. It was to initiate work on the conservation of these creatures which was a major reason why my post-doctoral student, Liz Chadwick and I were there. In contrast with Boavista, on the trade wind-lashed eastern beaches of Sal, we followed turtle tracks through the nets, ropes and buoys of ocean debris, past abandoned holes impenetrable with litter, from where they returned to the sea perhaps to try again another night. At least they could return, but where tourist development spreads, I think of the

nineteenth century Enclosure Acts in the UK when “the common was taken from the goose” or in this case the beach from the turtle.

I hope, however, I caught a glimpse of the future on the actively volcanic island of Fogo. We returned from the crater, below the 2829m peak, where vineyards grow on black volcanic grit, to its capital of São Filipe. There on the sea view terrace of a restaurant, with a bottle of Fogo wine, we watched as darkness closed the view of the nearby island of Brava, and, as we told our host of a group of turtles feasting on shoals of euro-sized jellyfish just off the town beach, her cook recalled that the previous day a local fisherman had caught a turtle and brought it ashore, he was reported to the police and the animal returned to the sea - a hopeful sign of attitudes for the future. “Hear that bleating?” said our host “That’s tomorrow’s goat stew” Yes, we were still in the very real world.” But these were my words of yesterday – what about today?

Sustainable tourism in Santa Maria, Sal, Cape Verde

The Cape Verde consists of islands of contradictions, of good news and bad news and a dubiously environmentally sustainable future. My interest in the islands related to their environmental and commercial vulnerability in the light of rapid and at that time seemingly largely unregulated change. Liz Chadwick and I put together our analysis of the problems and opportunities facing Santa Maria as an example of how the rip tide of tourism needs to be managed. The final paragraph drew together our thoughts.

Santa Maria, for many will become a tourist paradise, with endless sun, clean wide beaches and mushrooming seafront hotels. Look behind the façade and it quickly becomes clear that “progress” comes at a cost. It is clear that the race for growth has started without looking at the course or delimiting a finishing post. It will not be possible to restart the race but the course is still flexible enough to get the foreign backers of these developments to take the environment into account.

It must make long-term sense to utilise the natural renewable energy resources and to turn away from expensive, unsustainable, energy wasting activities such as watering lawns with desalinated water. Suitably treated waste water could easily be used for sensible plantings and indeed for a modest market garden industry supplying fresh vegetables to the town. A walk along the western developments at Santa Maria will show that hotel grounds can be greened with native plants as well as grass and that where this wasted irrigation water seeps into the surrounding dunes and creates a wet area, the egrets, ibis and waders flock in, clear evidence that water treatment in the old Salinas just behind the town, would bring in both the birds and the tourists to see them. It would seem that many of the new tourists will go for the all inclusive resort hotels but the conventional hotels and rapidly increasing apartment blocks will cater for people who might wish to see more of natural Sal. Currently opportunities are limited and what opportunities there are, are being provided by foreign owned hotels and boats. Local guides trained in eco-tourism, to take the public to safely see nesting turtles or whales and dolphins or indeed the birds of the Salinas, would both divert money into the local economy and give local people a pride in their own land.

A decade on

Moving forwards a decade were our worst fears justified? Some people are now clearly saying the right things but can they deal with the extent and pace of change? In 2014 the EU created a £45 million fund for renewable energy which is essential for education, healthcare, economic growth, tourism and even water supply. The aim is to generate 50% of energy through renewable sources by 2020 with the aim of ultimately reaching 100% of supply, even though demand will double in the present decade. There are now solar parks on Sal and Santiago and windfarms to harvest the Trade Winds on Sal, Santiago, Boa Vista and São Vicente. There is currently an almost 10% per annum increase in hotel numbers spread across the five main islands with most on Sal (with 44% of all hotels) and Boa Vista (31% of hotels) and 80% of tourist accommodation

remaining on Sal. International visitors are expected to rise from 500,000 in 2014 to 760,000 by 2024 with the tourism workforce rising in the same period from 32,000 to 65,000. Currently this is the highest tourist growth rate in sub-Saharan Africa. On Sal in 2014 only 10% of its 20,000 population was over 40. On a small scale some developers are taking the environment into consideration.

The Sambala resort on Santiago uses its green credentials as a selling point in its sales brochure saying “we are continuously exploring... initiatives that will reduce our carbon footprint. These include wind powered renewable energy, solar, biodiesel, sea water greenhouses, recycling almost all waste and much more. Sambala is setting aside a large portion of their land parcel as a nature reserve to help allow turtles to nest.”

Talking to local people, there is the feeling that, in many ways, the real financial benefits of the developments are going to the bank accounts of foreign developers, currently mainly Spanish and Italian, leaving local people with only menial work, financially exacerbated by the increasing cost of living through competing demand for basic resources such as fish and vegetables. This is still a country where medical risk is largely economically determined.

There is need for both vision and planning, and a desire, or if need be, a requirement, to ensure developers fit tourist development sustainably and sensitively within the delicate environments of all the islands.

“We believe tourism is not only sea and sun,” stresses, Cape Verde’s Tourism Director. “We don’t want to be the next Canary Islands. We have learned from our initial mistakes when we developed tourism infrastructure without control.” WWF believe that there are rays of hope as the government starts to realize that it must take the protection of the environment seriously and that they need to strengthen their environmental legislation, as well as conduct environmental impact assessments, carried out by independent experts and not by tourism investors themselves. For example, a project on the island of Sal illustrates the need for this control as it aims to build a marina and a tourist resort for 15,000

people in the middle of a marine protected area where humpback whales feed.

There are concerns about the type of developments progressing on Boavista and that although the country has environmental legislation, such laws are only as good as their implementation. People are saying the right things but it is the conversion of these sentiments into actions which will be the saviour of the Cape Verdean environment. There have been no major developments in water conservation, waste management or recycling. The real possibility of turtles becoming extinct on Sal was first mooted in 2011 and still remains a distinct possibility. Key to many of the islands' problems is the continued lack of integration of local communities with tourism infrastructure.

The Cape Verde islands have possibly some of the best beaches in the world, true tourist magnets, we have been to them, but seeing what is currently happening in Sal and elsewhere we are concerned that the Cape Verde infrastructure has not the strength to resist the uncontrolled lure of the Euro and Dollar. The state of the Cape Verde islands in 2014 is summed up to me by two images, one sent me by one of the new wave of British visitors to Boavista of Santa Monica beach, once when I visited, one of the remotest, deserted and beautiful places I had ever seen, but now in the backyard of hotels with warnings of muggers if you wander too far from "civilisation" and the other, a You Tube video of the volcanic eruption in November 2014 on Fogo, showing villagers carrying what possessions they could, often on their backs, from the advancing front of lava, contrasting natural dangers and poverty in non-tourist dominated areas against the dangers created by affluence.

6. Ecotravelling Downunder

One of my interests has always been in how wildlife is presented to the world through the media and through tourism. Elsewhere, I bemoan the loss of nature for the sake of the tourists' money but, perhaps on the pretext of ecotourism research, I have frequently taken on the mantle of the paying guest to see for myself how wildlife is presented to the general public and what problems it faces and not least to experience for myself the joy of ecotouristing – seeing the wild world as it is beyond the television screen.

Where better to begin my eco-tour Down Under than Perth, which is perhaps my favourite Australian city and the west, my favourite part of the sub-continent, and to visit it in its spring is undoubtedly a bonus. Kings Park, containing the Western Australia Botanic Gardens, is widely regarded as one of the world's largest and most beautiful inner city parks. Here you can find over 3000 native plant species and at times see some of the research work in horticulture and conservation which goes on there. The long avenues are lined with tall eucalyptus, some over a century old, many carrying a plaque to honour an individual soldier who died in war. In spring the avenues and hinterland are scattered with the exotic flowers of wild orchids, in the less wild areas, they appear through swathes of the pale flowers of freesias, an invasive non-native pest in these parts. This area was almost as colourful and certainly more botanically varied than the cascades of orchid colour I had seen in the Botanic Gardens in Singapore during a break on my journey south.

It was a visit to a greenhouse in the park which almost literally germinated the idea for a peatland regeneration project back in Wales. On the staging inside this greenhouse, was a ten metre long by one metre wide, 50cm high cloche, with a smoke generator at one end, with a gentle fan directing the smoke along the tunnel and on the staging were trays of germinating seeds. Evidently, many plant species in Australia germinate after wild fires and require the stimulus of smoke

to break their seeds' dormancy, very like our own heather, hence my idea for a project which I linked to the reinstatement of heather moorland after forestry removal, on a potential wind farm site which I was studying back in Wales.

Along the Swan River from Perth is the port of Fremantle, great place and great sea food and on the couple of occasions when I have visited, tall sail training ships have been moored along the quay, sometimes ready for the long sail back to the UK. Deeper in to the port were the facilities for the infamous "sheep crates", vessels, many decks high, for the mass transportation of live sheep to Asia and the Middle East. The best boat, in my view was the ferry from Fremantle (Freeo to its friends) to the 6km² nearby Rottnest Island, a journey taken from the mainland by half a million people per year. The joy of Rottnest is the absence of motor vehicles, with most people exploring the island by bicycle. The Rott (or rat) of the island's Dutch name is a hare-sized marsupial called a quokkar which is relatively easy to find. There are colonies of Australian sea lions and southern fur seals around the island's coast, but what I enjoyed most was looking out over the southern ocean and seeing, within binocular distance, the spouts of breath of blue whales and pods of hundreds of bottle nose dolphins racing just beyond the line of shoreline breakers. With whales and dolphins ticked off what other sea life ought I to find on Australia's west coast?

On the map, about halfway up the west coast of Australia is an obvious bay, doesn't look far on paper, but when I asked the car hire representative in Perth how far it was to Shark Bay he replied "About a thousand K" and how long does it take to drive there? "Locals do it in a day but pommies usually take at least two". In fact his 1,000km turned out to be something over 800km or 500 miles, and not wanting to look like a whinging pom I said I would take the car and get there in a day. I had never been asked before if I would like a mobile phone to be added to the hire, but I was advised to take some liquid to drink, but why would I want a mobile phone. Very early next morning, and traveling on my own, I began the journey north and before too long I seemed to leave civilisation behind. I was

traveling on Highway 1 which circumnavigates Australia. After 200km or so I got to Geraldton, refueled and stretched my legs. Much of the next few hundred kilometres explained why I was offered a mobile phone. The road was dead straight through a land of parched red soil and dead scrub. Almost no traffic except perhaps one land train (a lorry with four or five trailers) per hour, very hot and only the occasional road killed kangaroo for company. I spotted a sign saying "No fuel, no water for 140km". In that distance there were no people, no buildings just unending outback. At the end of the 140km was a small road house reminiscent of a British Little Chef with fuel, water and food and yet another road sign "No fuel, no water for 140km". After another 140km there was another sign and another road house. Eventually the seemingly endless, unbending road had a left turn to Shark Bay and I arrived there as night fell – no whinging pom me!

Shark Bay area has several attractions to the eco-traveler not least the largest and most diverse area of sea grass beds in the world. Such a flora maintains a rich fauna, not least among which is the world's only strictly herbivorous marine mammal, the dugong, a 3 metre long, 400kg relative of the very similar manatees and can be separated from the latter by the possession of a forked tail. Although found in the coastal waters of at least 37 countries, the dugong has been lost from a significant part of its range over the last century, and is regarded by the IUCN as vulnerable. The population of dugongs in Shark Bay, at some 10,000 individuals, is the densest in the world. From some shore-line vantage points it is possible to see their muddy feeding tracks through the beds of sea grass and sometimes it is even possible to see lines of bubbles following them caused by the flatulence of a high fibre diet.

The distribution of dugong and the three species of manatee do not overlap, but together they constitute the mammalian order Sirenia (the sirens of mythology and the mermaids of legend).

How could anyone come to this part of the world and not want to see these fantastic creatures? At Monkey Mia, a resort on Shark Bay, it is possible not only

to feed wild dolphins from the shore, but also to sail silently on a catamaran, so as to cause minimal disturbance, to view these great grey “mermaids” at close, but discreetly not too close, quarters.

A short (by Australian standards) drive back towards Highway 1 is Hamelin Pool, an isolated inlet of the sea where evaporation makes the water twice as saline as normal sea water, which inhibits most marine life to the advantage of the remainder. Here you enter a brilliantly white, 60km long, shell beach, up to a kilometre wide and ten metres deep, made up entirely of ten to fifteen millimetre long shells of the Hamelin cockle. Inland, over millennia, these shells have compressed into soft coquina limestone used locally as building stone. In the fierce heat of this area the super salty sea has saved the best until last. In the shallow waters of the shoreline of this inlet are dome shaped, metre wide microbial mats called stromatolites, whose constituent algae are thought to be some of the oldest life forms on earth, providing oxygen for the atmosphere for 3.500 million years. Not the most conventionally beautiful of organisms, but surely one of the living wonders of the world.

Further north on Highway 1 is Broome, but I cheated as on a later visit I flew there from Perth en route to the Top End and Darwin. I remember Broome because we touched down there and had to wait in the “departure lounge” which consisted of seats under a very large tree. On a subsequent visit to Shark Bay, being short of time I flew in, and here the airport infrastructure consisted of a table under a tin roof, and a wind up telephone, which was taken out of a bag and activated to become the incoming plane’s air traffic control for landing and you were your own baggage handler.

Darwin is the focus for access to the Northern Territories and on a walk through the town towards the sea you might well encounter, as I have, metre long monitor lizards walking across a hotel lawn, or if muddy creeks are approached quietly, scores of mud skippers, these unfishlike fish, perched on the wet mud with their

tails often dipping into their water filled holes, where a sudden movement will send them in the blink of an eye. This town is your base before you enter one of Australia's gems, the Kakadu National Park at 20,000 km² the largest National Park in Australia, with the emptiness of Arnhem Land beyond. It is an area of vast wetlands with escarpments to the east. You can either fly in to the park and get a bird's eye view of the land, dip down low over mud flats if the pilot spots a real crocodile, certainly see the famous crocodile shaped hotel at Jabiru from above, and even the big scar of a uranium mine as you come in to the air strip, or you can reach the same point after several hours driving. On this occasion, choosing the long drive from Darwin through eucalyptus scrub, with three metre high termite mounds, I remember stopping for lunch at a fairly basic café run by a local aborigine family and having effectively fish (barramundi) and chips and looked at my bill to find that *use of a plate* had been itemized and charged for! – Although in retrospect perhaps little different to the question “Eating in or take-away?” in a UK chip shop, but an interesting form of words.

While in Kakadu it is essential to put this wild and inhospitable country in the context of its native peoples and a culture far older than our own. Visit a site such as Nourlangie, where there is aboriginal rock art dating back up to 20,000 years and where, literally, every picture tells a story, and where the twenty-first century visitor could learn a lot about how to live in harmony with the natural world.

The Mecca for tourists in this area is the Yellow Water billabong, a tributary of the South Alligator River, a marvelous place to appreciate the wildlife of the area from the barramundi and archer fish in the water, to the giant saltwater crocodiles sunning themselves on the banks, water buffalo grazing the wetlands and birds of all sorts utilizing the whole environment. Tourists tour this waterway in vast numbers every year, but because they are contained in aluminium boats, and the wild life is just that, wild, the visitors do little harm, reversing the usual concept of wild life watching in a zoo.

Continuing around the edge of Oz I flew across to Cairns and, as a good ecotourist, the Great Barrier Reef and the Queensland hinterland were an unmissable part of my itinerary. Without the Reef, I doubt if Cairns would be more than a footnote on the tourist map. There are many options to get out on the water and see this natural wonder of the world. The most popular option is to take one of the massive catamarans from Port Douglas, a 70km drive north of Cairns, each boat ferrying several hundred visitors the couple of hours or so it takes to reach the line of breakers marking the reef itself. At the reef the vessel ties up at a pontoon and the reef can be explored in a wet suit or via a “submarine” or a subsurface viewing area, if keeping dry is a desired option. I was impressed by the experience not only by the coral and its corps de ballet of small colourful fish, but also metre wide giant clams and large grouper fish, species which seem to give scale to this enormous coral structure.

Australia is famous for its poisonous animals be they snakes, octopus or spiders, but rough seas on the reef a few days previous, had left some turbidity in the water and an influx of “blue bottles”, thumbnail sized, jellyfish-like creatures related to the Portuguese man o’ war, with long stinging tentacles, and although these were clearly small individuals, they were no less capable of stinging, which is why wet suits were the order of the day. The results of ignoring the warnings were clear, two foreign girls in conventional swimsuits were rescued from the water and left laying, semi conscious on the deck with vicious looking red weals on their faces, shoulders, arms and legs. They were shipped off to hospital on our return to port.

The reef, however, is the milch cow of the area, but survives under the constant threat of climate change, loss of coastal wetlands, pollution from mining and dredging, sediment and pesticide runoff, general eutrophication as well as shipping and illegal ill-treatment by tourists.

Wherever I go I like to sample the local food and Cairns is an excellent place to add to my tick list of “eaten that”. I can recommend the crabs whether mud, blue swimmer or soft shelled plus the Moreton Bay bugs, black-lip mussels and coral trout as well as the more mundane kangaroo or emu steaks or even crocodile sausage. But for the less adventurous, “reef fish of the day” and chips at the local chippie are a tasty choice. I noticed one local supplier listed forty locally grown exotic, mainly tropical, fruits and roots, most of which I had never heard of. I would need a long stay in Cairns to get through them all.

Most visitors take the Scenic Railway from Cairns to the small town of Kuranda and return using the Skyrail Rainforest Cableway or vice versa. I have met the queen on a couple of occasions back in the UK, but few people can say they had to wait in their vehicle while the queen swung about twenty feet above their head, albeit on the Skyrail cableway! This particular day I was driving down from the cooler agricultural areas of the Atherton Tablelands towards the tropical heat of Cairns. I had been there to visit a governmental agricultural research station run by the son of a university friend of mine living in New Zealand. As I entered the research station I realized that many of the exotic fruits which were listed by the supplier back in Cairns were growing in the orchards here with star fruit, peaches, mangoes and all manner of citrus recognizably cropping in profusion, amongst plants I had never seen before. This was a government funded base from which farmers could obtain agricultural advice and on this particular day a grass crop was being visited and I was invited along to see how things worked. We stopped at the field and waded deep in to this metre high crop at which point I was told that an interesting fact that this crop seemed to be particularly popular with eastern brown snakes which are listed as having the second most toxic venom of any land snake in the world. I returned back through the tall grass to the truck carefully utilizing the footprints of my guide. I was reminded that, of Australia's 140 species of land snake about 100 are venomous, so nothing particularly unusual about this farm and farm-land mouser, just a long thin “cat” best not trodden on.

The day before I returned to Cairns, I drove back to spend an evening at the Research Station Director's house, a wooden bungalow built to stand a couple of feet clear of the ground with a large open verandah facing towards the sunset. As we sat on this verandah, tinny in hand, we watched a wild turkey returning to its nest at the bottom of the garden, I made the rather English (or Welsh), and in retrospect, rather stupid comment, that I could not see how he heated his house when the weather was cold, and was patiently told that, although we were above the area of intense heat of the coastal plain, houses here never need heating – as I write, I am about to put another log on the very necessary fire back at home. The following morning I got up at daybreak because I was told that an early morning visit to a hide by a pool in the small township might reveal a real Down Under gem, a platypus. The road to the pool was only a few hundred yards away, but littered with probably a few tens of flattened invasive cane toads, victims of the popular pastime of toad popping, a descriptively apt, car based “sport”, a contrast to the British habit of helping toads across roads. It was in this area that I attended a cane toad racing event. Put a group of numbered toads in the centre of several concentric circles and wait for one to cross the furthest line. Simple rules but, as I'm not a great betting man, far less interesting than the toads themselves, and I haven't even mentioned toad licking for a chemical “high”! But I digress. I continued towards the pool and on the road was yet another casualty of the night which I was tempted to pick up, but, remembering warnings which I had been given that these could be vectors of a rabies-like virus Australian Bat Lyssavirus, I left the dead fruit bat and reached the pool. It was just after dawn, no one about and very still. After a couple of minutes, ripples disturbed the mirror flat water and there lying on the surface, limbs outstretched was my first real encounter with a platypus. I had seen them in an aquarium in a zoo in Sidney, and told that they caused the distant splashes I had seen on the Gordon River in Tasmania, but this was close, this was wild and it made my day. The main reason I had visited this station was to see their red-claw crayfish rearing

programme, but that is part of another story. An interesting journey and on my return to Cairns I did, almost, see the Queen!

Having been along the west then north coasts of Australia, I'm now moving steadily down the east and on to the south coast. Along much of the east coast there is a hot coastal plain, which inland gives way to a more temperate high plateau, the two being separated in places by spectacular cliffs and waterfalls set in some of the lesser visited national parks. Again on the trail of crayfish, this time yabbies, an Australian tea-time favourite so I am told, I drove up from the coastal plain up the escarpment of the Great Dividing Range's Northern Tablelands to visit a university campus in the town Armidale. This is a world away from the tanning sands of the coast, where here, in the shallow mists of morning, I watched the silent, saltatorial progress of the local kangaroos as I drove towards the Waterfall Way along this upland/lowland transition. I was heading to the spectacular Wollomombi Falls one of the tallest falls in the country, through a land of massive round boulders and eucalyptus forest but few visitors. Cars in the Australian countryside need to be reliable, and the one I hired here I found "interesting", as first, when I was low on fuel, neither myself or the pump attendant could find the fuel cap latch until, three people later, its location was discovered. Then when I reached these wild and spectacular falls and parked in the near empty car park, I noticed water dripping on to the dry sand, a leaking hose I thought, just what you need 50km from the nearest assistance. Seeking a second opinion on my problem I approached the driver of a motor home, the only other vehicle on the car park, and became the cause of great hilarity that I had not recognized condensation from the air conditioning system, something which at that time, I explained, was usually not deemed necessary in British cars. Armidale is situated about halfway between Sydney and Brisbane and the latter was where I was heading next.

There were several reasons why I had visited Brisbane and the Gold Coast not least to see some of its non-beach based "eco" attractions. I am not a city person

but I found Brisbane and its university a most pleasant location, not least because I could commute right in to the city centre by the excellent river service provided by the CityCats and City Ferries.

Zoos are something which people either love or hate, and provided they have a genuine caring or conservation role, then I believe they have a place. In comparison, some like those I had seen in Poland in the 1970s were at the other end of the spectrum of compassion. In Brisbane, The Lone Pine Koala Sanctuary is claimed to be the largest such sanctuary and rated in its own blurb, “one of the ten best zoos in the world”. If the claim is strictly true I couldn’t say, but it is certainly a place to come closer to both koalas and kangaroos than I have experienced elsewhere. An hour’s drive north of Brisbane is Australia Zoo, established by the late Steve Irwin who aimed to make it “the biggest and best conservation facility in the world”. Again, does it quite live up to the hype? It does certainly have an international conservation impact, and what really impressed me was the extent of public interaction with staff and animals. The crocodile and tiger “shows” are not exhibitions of taught tricks but tend to demonstrate what these animals can naturally do. I left thinking that this was indeed a good zoo.

I then ventured out to sea from Brisbane in to Moreton Bay, past Moreton Island the third largest sand island in the world, into a world of sea grass and dugongs, but far fewer than Shark Bay, together with sharks and loggerhead turtles. However, the bay is especially noted for its whales and has recorded eight species in its waters, but by far the most abundant, and which whale watching trips will guarantee you a 100% probability of seeing between June and September, is the humpback, on its long annual migration. This is an animal that never fails to impress and gives that shiver down the spine when you are close enough to smell its rather fishy breath as the spout of exhaled spray shoots in to the air and the great body lifts out of the water to silently sink with a wave of its tail.

Sydney is the place that seems to be either the beginning, or the end or just a transfer point of any visit I've made to Australia and New Zealand. It is a massive city in which the urban areas at the city edge seem to dissolve in to the surrounding eucalypt forest, but seen from the air, after the not too infrequent forest fires are black scars of destruction fingering right in to the residential areas. The Harbour Bridge, the Opera House, Bondi Beach and Circular Quay almost define the city in the minds of the world, but for me other things have left their legacy on my memory. If any ecological friends say they are visiting Sydney I suggest they go in to the Botanic Gardens which adjoin the Opera House and see the colony of fruit bats which hang out there, much to the dislike of the garden authorities. In the Sea Life Aquarium there were both dugongs and platypus, but much better to see them in the wild. There is a wide range of wildlife even in this built up urban area including sulphur crested cockatoos and a range of their smaller relatives, as Australian cities have the space to be quite green by British town standards. Keen as I am about wildlife the notorious Sydney funnel-web spider is probably best avoided.

There are some creatures which occur widely throughout the world, but not in Europe, so to see this particular animal, as other than pickled specimens, even if not in the wild, I found most exciting. But how could a velvet worm be described as "exciting"? These are not just worms, indeed they are not what would be conventionally described as worms, even though they are commonly called velvet worms because of their velvety appearance, these are properly called *Peripatus* a true living fossil, first recognized from Cambrian rocks of some 520 million years ago. Here in Macquarie University in north Sydney where the animal is the subject of study, I had one walking over my hand! This primitive creature is often seen as an evolutionary link between arthropods (insects, crustaceans etc) and their predecessors. Although the animal is not rare in terms of distribution, for me, the opportunity to handle it was.

Elsewhere in Australia, my travels were mainly to see the tourist sites; Uluru (Ayres Rock) three and a half flying hours from Sydney (same as flying UK to the Canary Islands), been there, seen that, and Adelaide and Melbourne via the Great Ocean Road, come in to my crayfish story, as does Tasmania, with its wild forests and incongruously polluted rivers, but this offshore island nevertheless remains my favourite Australian state.

Thinking of flight times, Auckland in New Zealand is some three hours from Sydney and in a different time zone. Drop me in North Island New Zealand and tell me I had to stay and I would settle in quite well, in a temperate, green land with relatively quiet roads and lots of sheep, yes, very like rural Wales, but a bit warmer. Anyone traveling with me to New Zealand (daughter or students – too far for wife Liz) usually got my guided tour of the spots I really like. If traveling alone I usually headed north from Auckland towards the Bay of Islands and one of the best seascapes you could wish to see and Waitangi where, in 1840, the treaty of Waitangi was signed between the settlers and Maori chiefs, regarded as New Zealand's founding document. In company, however, an early long haul arrival in Auckland, usually around 5am, meant collecting the hire car and heading out for a couple of hours towards Hamilton for a 7am breakfast, then on to the Waitomo Glow Worm Caves for opening time at 9am, to see the impressive light display by the larvae of a fungus gnat *Arachnocampa luminosa* suspended by treads from walls and ceilings and emitting a luminous green light. The nocturnally glowing species is endemic to both islands of New Zealand but conveniently seen in the daytime darkness of caves in this popular tourist site. An hour and a half's visit here and it's on to Rotorua its hot springs and sulphurous air by mid afternoon. The young, having little staying power, have always refused my offer of a tour of the sites of the town in favour of (usually 12 to 18 hours') sleep claiming a flight from the UK plus my arrival itinerary exceeds their physical and mental ability to cope.

Wherever you go around Rotorua the smell of the sulphurous steam seems ever present. Every house seems to tap directly in to this layer of hot water but the resource might well be becoming overexploited. This is a good place to see Maori culture, even if glossed up for visitors, and to take a traditional Maori feast or hangai, where food is traditionally cooked in pits in geothermal areas, is a gastronomic experience, especially if sea food such as abalone or sea urchins, but more typically mutton birds are included. Cooked in seafood stock, mutton birds can be quite tasty, and are in fact young sooty shearwaters legally harvested from colonies sometimes exceeding two million individuals, and are one of the most numerous seabirds in New Zealand.

At some of the visitor attractions near Rotorua, such as Rainbow Springs, it is possible to see, in a relatively small area, many of the creatures of New Zealand which would take an entire excursion to find in the wild. Thinking of food, the country produces some excellent trout but to see forearm thick, long finned eels, a metre plus in length, at the Springs, makes Wales' declining eels look puny. This may be a tourist attraction but still a good place to get acquainted with the tuatara, a primitive lizard with the remnants of a third, pineal eye, strange but true, just like the flightless kiwi with its eye-wateringly big egg and the South Island kea, the mischievous parrot of the other half of the country, all here together with the common birds of the region such as the descriptively named silvereye and the blackbird sized tui, a black bird with a white chest spot and a call like no other.

As a botanist, the tree ferns forming low fern forest or a fringe around forestry plantations, always have an exotic attraction, but particularly so for fans of rugby as the All Blacks proudly wear the silver fern as their national symbol. In the moist woods, the trees are covered in epiphytic ferns and bryophytes (liverworts and mosses), many of which in Rainbow Springs are labeled for the discerning visitor. A connection between this antipodean attraction, my home in Wales and my connection with the Royal Welsh Agricultural Show, is that here near

Rotorua, one of the visitor attractions is a Sheeptacular, a show demonstrating the various qualities of the sheep breeds of New Zealand and how they are handled by the farmer and his dogs. At one time this whole event was packed up and brought annually from Rotorua to the Royal Welsh and proved very popular, so popular in fact that a Welsh version is now resident at the Royal Welsh Summer Show with Welsh sheep breeds, Welsh sheep dogs, demonstrated by Welsh farmers.

From Rotorua south towards Lake Taupo, the country's biggest lake, the land steams and bubbles with volcanic activity so much so that it formed ideal country in which to film the Hobbit series, and, more in keeping with my interests in renewable energy, geothermal power stations utilizing this volcanic world's free resource. Having worked on short rotation willow coppice (src) as a source of renewable energy, with a particular interest in its impact on wildlife, it was useful to have the opportunity to work on a src area near Taupo. Set deep in forestry, with a raging river to one side and steaming vents all around, the site has a slightly unworldly feel. We (myself and PhD student Danni) were told the area was hand planted by prisoners who found themselves so intimidated by the isolation of the site that their supervisors had no fear that they would try to abscond. The interesting thing about this study into the birds and plants of the src plantation is that very few of the birds or plants (weeds) were ones we would not find in the UK. The first colonists to New Zealand brought not just livestock but also the birds of home – just turn, for example, to the finches' page of any book on the Birds of New Zealand and it will be almost identical to corresponding page in a British bird book. We did catch some local species, commonly the silvereye and the fan-tail, but imported species always predominated here and in the general countryside from the flocks of Indian hill mynahs in the northern fields to the ubiquitous house sparrow.

Some years earlier I had crossed the Desert Road from Taupo to Palmerston North, past sometimes lightly smoking volcanoes, in more Hobbit country, to visit

my then students doing similar work on birds of biomass and other crops, in facilities owned by Massey University in Palmerston North. This included work on birds in willow and kiwi fruit plantations, as well as developing a camera system to record root activity in eucalyptus biofiltration plantations.

There is a very serendipitous reason why all this activity of ours took place in Massey University. One of my PhD students was growing short rotation willow crops here in mid-Wales, but, come autumn, the plants became dormant until the following spring. The only way which we could think of to gain the data from an extra growing season was to head off to the southern hemisphere, and so the student was persuaded to look through the literature to find people in the southern hemisphere researching woody biomass crops who might be able to give a student a base for a few (UK winter) months. The emails went out with no positive replies, until one day, a man walked in to the Llysdinam Field Centre office, asked if the student concerned was about, and said his name was Dr Ralph Simms from Massey University in Palmerston North, New Zealand. Over a cuppa I said that one of only two people I kept in contact with in New Zealand, from my student days in Aberystwyth, was my former room mate who was now Head of English in the Girls' High School in Palmerston North and whose wife was a librarian at Massey. "What a coincidence" said Ralph, "my wife teaches English at the Girls' High School and so your friend must be Alan Cox her Head of Department". He was quite right, and I'm still amazed, these years on, that a coincidence like this can occur.

Although I have encountered snow on the Desert Road across central North Island, and the climate certainly cools as you head south in New Zealand, nowhere in inhabited North Island would I class as cold, although the locals may disagree. Staying with my friend Alan Cox in Palmerston North, I was told to wrap up warm because it was one of the coldest days of the year, so I prepared for the worst, only to find there was the merest touch of frost on the lemon trees in the garden – I rest my case! Alan's largely wooden house was in a quiet suburb of

the town, but in the morning I asked what the noisy, heavy lorries had been up to in the early hours in his quiet cul de sac. Anne, his wife, reminded me of the advice she had given me when I arrived, that, in case of an earthquake, stand in a doorway. So that was a 'quake, a regular accompaniment, I was told, to life in this part of the world.

The road from Palmerston North to Wellington on the south coast was, for me, generally the road to the airport, perhaps flying north to Auckland but in this case south over the sea to South Island. There were two reasons which made me visit South Island and both bird related. On this occasion, my first visit Downunder, and I was to attend an international bird conference in Christchurch where we were welcomed by a Maori leader who spoke of us delegates being "half a world" away from home. Yes, in spite of the fact that the people, the food, the language and even cars driving on the left, all being reassuringly homely, it suddenly dawned on us that we were almost as far from home as it is possible to be.

The second reason for my visit was David Attenborough, and that was also bird related. Having watched the great man's television programmes over many decades, and he did even film in Newbridge-on-Wye on one occasion, some things he has done just make you think, "I should do that too". One such experience was to visit the nesting site of an albatross, in this case the Royal Albatross at its only mainland nesting site at Taiaroa Head near Dunedin on South Island. The site is reached by a long coastal road heading along the peninsula, a coast rich in sea birds and even the occasional fur seal. The albatross site is as secure as a fortress, to keep out human and other predators, but well managed with good views of these majestic birds. For me it was well worth the journey to see these birds with a two metre plus wingspan glide in to their beak clattering mate, to take charge of their single egg or chick, truly memorable moments.

In the waters of another headland, Akoroa, near Christchurch I sought out and saw another specialty of this part of the world, Hector's dolphin one of the world's smallest dolphins at 1.4m and New Zealand's only endemic cetacean.

This pale grey animal with black extremities tends to be found along the western and southern seaboard of South Island. It is a species in decline largely due to losses from individuals accidentally caught in fishing nets, a problem which has caused the government to implement strict laws on the placement of gillnets in coastal waters. In addition to dolphins we also caught up with fast swimming groups of small blue penguins.

One of the joys of conferences attended by like-minded individuals is not just talking "shop" but using their local expertise to show off the wildlife of their part of the world. But, one of the most famous birds of South Island I was not going to see in the wild. The takahē, the largest flightless member of the rail family, was thought to be extinct until refound in the tussock grasslands of South Island in 1948, and fortunately it was on display at the Mt Bruce Wildlife Centre, on the road between Palmerston North and Wellington so, perhaps cheating somewhat, I was able to tick it off my to see list. The problems for this 3kg bird include hunting, (though a rare problem now), nest predation by stoats, and overgrazing of its tussock grassland by deer, both very successful alien invaders. But conservation measures, including controlled breeding, nest and habitat protection, release on predator free islands and predator excluded mainland sites are slowly bringing the bird back from its critically endangered state.

From my university accommodation in Canterbury overlooking the students' playing fields, I noted some of the species I had seen from my window, blackbird, song thrush, skylark, chaffinch, house sparrow, dunnock, greenfinch, goldfinch, redpoll, rook, starling, cirl bunting, and, oh yes, New Zealand native white backed magpies, and here I was some half a world away from Britain looking at birds brought by early settlers to remind them of home

Moving away from the university, on to the sheep bedecked Canterbury Plain, where rivers, such as the Rakaia, create the most spectacular braided channels out of the eroded debris of the Southern Alps, with diligent search you can find a small, but somewhat confiding wader, typical of the gravels of the rivers of the Canterbury Plain. In Britain, living away from the coast for most of my life, I have never got terribly excited by waders, except perhaps the curlew and lapwing, once abundant in Wales, but now qualifying because of their scarcity, for at least a second look, but certainly not small waders. But here, well camouflaged amongst the riverine pebbles, is the wrybill. What is special about it is in the name, as unique amongst waders its bill turns to the right, perhaps allowing it to keep an eye on the sky whilst probing for prey.

To get from Canterbury to the west coast means, that once across the plain, you need to cross the Southern Alps and one of the few ways to achieve this is via Arthur's Pass, at up to 900m, the highest of the passes through the range. This takes you in to the Arthur's Pass National Park, passing tall, eroding mountains with grey scree slopes, on beyond Lakes Lyndon, Pearson and Grasmere to where the range dividing rivers run through flat, wide braided channels where the forests cloaking the river and valley sides are of *Notofagus* or southern beech. After the lowlands and their alien fauna, here you feel you are in the real New Zealand. But it has taken several hours drive to get here just looking for two native species, the first of which is the blue duck, a specialist of mountain torrents which we find relatively easily in a roadside river due to the local knowledge of our guide. The second is a smaller finch sized bird, the yellowhead, once widespread in the native forests, but now we were looking for the only known pair in perhaps several thousand hectares of *Notofagus* forest. We set off on our search using the flat braided channels of the river to move deep in to the forest. After an hour or so we find our first and only pair of yellowheads, which, true to their name, are yellow on both head and body except for a grayish brown back. This is beautiful and exciting country for an ecologist like me, but at the

same time the rarity of these once much commoner native species is disturbing and a lesson in how not to introduce alien wildlife into a pristine land.

To complete my ecotour of OZ and NZ I must include Tasmania, although it also appears elsewhere in my story in a slightly different guise. After New Zealand, Tasmania is probably my favourite place down under. Although only 250km from mainland Australia, the climate is temperate and the fields green and the relatively small state is not overpopulated, having vast areas of wild country to explore. It is the sort of area where it is reasonably possible to circumnavigate in a week or so, although more time is preferable. For the historian arriving in Hobart in the south of the island, there is history of British convict ships and Port Arthur, good food and wine for the general visitor and the excellent University of Hobart for the academic. Although modern academia would count it as mere stamp collecting, I think I would have found a life at Hobart's university really exciting, as many of the academics, often English ex-pats, had discovered species new to science in a range of fields. Mount Wellington which literally backs on to Hobart has its own rare species so there is not far to go to make discoveries. If names make you feel at home, then to the north there is Launceston on the Tamar River, and elsewhere Swansea, St Helens, Ambleside, Devonport and Ulverstone. The joy of the island is that centrally and to the east there is rich agriculture and vineyards, whereas to the west is the Franklin-Gordon Wild Rivers National Park creating what has been described as the "dark forested heart of the country".

Head north from Hobart and there is spectacular country with pristine lakes and peaty heathlands of button grass, where under trees on the drier knolls wombats create their badger-like dens. Although the legendary Tasmanian tiger or thylacine may (or some think may not) have gone, there are plenty of creatures still remaining from quolls and possums to prickly echidnas and macropods such as Bennett's wallaby and the endemic Tasmanian pademelon. But it is the Tasmanian devil, with its famously fierce face and unpredictable temperament,

which sums up the tribulations of Tasmanian conservation. Loveable in a devilish way, the animal is popular with the public, and there is a genuine desire to conserve it, but nature has conspired against it. An infectious cancerous disease has spread through the population putting it under threat, so that facilities, such as the Mole Creek Trowunna Wildlife Park, with the world's largest captive population of the species, have the unenviable task of protecting a national treasure.

In the western National Parks there are still areas hardly explored where, who knows what might be found. A glimpse of pristine wilderness can be seen by visiting Strahan (generally pronounced Strawn) on the west coast which gives access to Maquarie Harbour and the Gordon River. The trees of the rain soaked fringing forest hang rich with moss and ferns, and in spring, the white flowers of leatherwood, a Tasmanian endemic, and source, in my view, of perhaps, the best flavoured honey in the world, contrast with the forest green. Here eucalyptus shares its land with the now rare Huon pine, a timber sought by boat builders and furniture makers but now totally protected, so that only small amounts are left available to amateur woodworkers from waste left from when logging the species was legal. It was distant splashing here on the Gordon River which, I was told was (my first sight of) platypus. This idyllic country of forests and rivers is where, in the 1980s, there was a great dispute between conservationists and developers over plans to dam and flood this pristine forest for a hydroelectric scheme. On this occasion the conservation lobby won and the British conservationist Professor David Bellamy was famously jailed for his part in the protests and this became the most significant environmental campaign in Australian history.

Between Strahan and the beautiful Lake St Clair the countryside can be quite a shock. In towns like Zeehan and Queenstown some of the rivers still run red with pollution from the legacy of mining for lead, silver, tin, copper and even alluvial gold, and the industry still continues but in a reduced form.

This part of Tasmania tells a story, familiar to many ecologists, of pristine forest areas abutting the once-deemed-necessary despoliation of past industry; and the David and Goliath battles between conservation and hydro-power developers, which in this case the David of conservation won with his slingshot of reason. On the other hand there are animals which we all want to save, but who have been dealt a diseased hand in the lottery of fate. Australia and New Zealand as a whole, have a different natural living vocabulary of species to much of the rest of the world, but the stories they tell are of disastrous introductions of non-native species, the potential effects of bad management of resources on the natural environment and the need for a carefully controlled ecotourism environment to protect the vulnerable using the tourist dollar – now where have I heard that before?.

7. Bits and Pieces from Here and There

I have traveled quite widely if thinly in the USA, but only a few ecothoughts tend to remain. I know that Boise in Idaho is the potato capital of the world; Oregon for cob nut oil and some good grey whale watching; Hells Canyon on the Snake River on the Idaho Oregon border is deeper than the Grand Canyon – saw black Bears but no snakes; the train through the Rockies from Vancouver to Winnipeg, and the Niagara Falls both seem to have been tamed, either by being able to sit comfortably as we rattle slowly through tough country or by nocturnal illumination of the falls and the constant trails of plastic caped visitors, colour coded according to the experience they had purchased.

I must admit that I found the vast glacial lowlands of the Minnesota plain west of the Great Lakes, more to my liking, and more memorable than some other areas. Here in Minnesota are six million acres (some 2.4 million hectares) of peatlands and peaty soils, some actively farmed and some long abandoned. Kentucky blue grass is grown here, as in a few other states, and exported all over the world. In the UK we know it as smooth meadow grass (*Poa pratensis*) although only in the States do you have Bluegrass Country. In wetter agricultural areas the black-grained wild rice is cultivated, and out of one such field I saw my first American bittern. But, what I was here to see, was the biggest peatland in the United States, Red Lake Peatlands some 50 miles long and 12 miles wide, dwarfing anything similar in Britain. This is a highly diverse area of patterned bog lands with open fen, black spruce woodlands, with an understorey of Labrador tea and with open areas of sundews, pitcher plants in beds of *Sphagnum* moss. Still to be seen, particularly from the air, but not used since the 1930s, are the traditional migration tracks of thousands of caribou, etched for seemingly all time as scars in the bog surface.

Without venturing too far on to the peatland there were fresh moose tracks to be found and the road I was on was the divide between two packs of timber wolves.

With a better view of this vast area than my land locked self, a bald eagle made its leisurely way above the swamplands. This to me was unspoilt wilderness, a dreamland of pristine nature – but wait, proposals were then afoot to excavate and gasify the peats from 300,000 acres (about 121,000 hectares) of the Red Lake Peatlands, turning living nature into fossil fuel. Fortunately, common sense prevailed and by the 1990s the area was preserved as a National Park. My base for this venture was the city of Duluth, on the most western point of Lake Superior. The size of this lake is impressive, as it should be, as it is the largest continental lake in the world, with a surface area of 82,000km² and a volume of 12,000km³ with ocean going vessels coming to and from the port, many to collect grain. What sticks in my memory is the view from my top floor hotel room looking out over the lake and seeing nighthawks (relatives of the nightjar) nesting on the flat roofs of adjoining hotels and watching the almost nightly thunderstorms, common in this most continental of continental climates.

It is perhaps satisfying to see some of the great cities of the USA and “tick them off the list”. But of New York (too claustrophobic), Washington (except for the Smithsonian Museum), Philadelphia (except for running up the “Rocky” steps), Los Angeles (there with daughter for Disneyland at Anaheim) and San Francisco (except for Pier 39 and its sea lions) I can take them or leave them and more the latter than the former.

Now South America is different, not full of North Americans for one thing! Sorry Americans, it's not you but your consumer, high input society which grates on my love of the wild and the simple. After a few occasions when passing through the US, the unwelcoming, officious, bullying attitude of immigration officers towards long haul flight passengers annoyed me to the extent that I have subsequently taken more southerly routes through the generally more welcoming countries of South America.

My stays in Chile have been fleeting and I have not had the opportunity to visit a former student of mine, now an influential scientist, who worked for me after fleeing from the Pinochet regime. I sent one of my students to an otter conference there so missed the opportunity to see for myself the southern river otter and Chilean marine otter or the freshwater crayfish *Samastacus spinifrons* of Chilean rivers. I have seen the impressive street entertainers of Santiago, but that's not quite the same.

In Peru you feel that you are in real South America. The language is Spanish, the dress often traditional and the country amazing. Once the airport at Lima has been negotiated, it is on to Cusco at 3400m (11200 feet) historical capital of the Inca Empire, situated in the foothills of the Andes. Gastronomically, this is the place to sample llama steak and Guinea pig ("rodent" on the menu), the steak is good but "rodent" a bit dry if roasted, better in a stew. Cusco is the starting point to explore the ancient sites of Inca Peru, and although not my main reason for being here, I thought that I must take the opportunity to visit Machu Picchu.

Machu Picchu is surprisingly at a somewhat lower altitude than Cusco being a mere 2430m or nearly 8,000 feet and approached, by most time-limited tourists like myself, by train along the "Sacred Valley" of the Urubamba River, flanked by mountain peaks reaching up to almost 6,000 m or 20,000 feet. The city of Machu Picchu itself, perched on a high mountain side is impressive, not only in location, but in the skill of the original stone masons, fitting together stones half the size of a modern car with millimetre precision and without metal tools, I take off my super soft, woolly, alpaca hat with ear flaps to these craftsmen of the past. On the return train journey, I start to enjoy the fact that I am on a real journey, here in the middle of the Andes, towering peaks on either side and thousands of miles from home, when someone leans over from the seat behind and says "I 'erd ya torkin, Yo must come from Walsall" – my cover blown, I wonder how far away I must go to achieve the anonymity of distance?

My real reason for visiting Cusco was as a staging post to the western side of the Amazonian forests. From Cusco we were to fly by small, fourteen seater Cessna plane for an hour or so to the grassy Boca Manu air strip, deep in the Amazonian jungle, before traveling along the Rio Madre de Dios (River of the Mother of God) to the Manu Wildlife Centre, in my search to see the giant river otter. At the airport, everyone took turns to stand on the scales with their limited luggage, and when the total weight was deemed OK for the plane, we took off over the agricultural fringe of Cusco. "What are they growing?" I asked, "asparagus for the export trade, Peruvians don't generally eat it" I was told. Soon we were over the mountains and on to the seemingly endless forests, of a patchwork quilt of trees, in all shades of green, which is not surprising when there are up to 250 species of trees per hectare in some areas of forest. Rivers snaked through the forests eventually feeding in to larger tributaries of the great Amazon River flowing from here to the other side of the continent. The pilot said he was beginning his descent to Boca Manu, but all of a sudden he banked upwards and swung round to the other end of the landing strip. "Sorry, but there was a harpy eagle" (the biggest eagle in the world) "on our approach path, so I'm coming in from the other side", a good omen I thought for wildlife spotting on this trip, and I was, almost, right.

The river journey, by a large motorized canoe, was a good introduction to the riparian wildlife. We were told that in these forests there were many thousands of species of plants, nearly 1000 species of birds, 1300 species of butterfly and 600 species of bees and of the 200 mammal species, 100 are bat species, thirteen species of primates in addition to twelve reptile and 77 amphibian species. How many would we see? The river introduced us to river turtles sunning themselves in line along half submerged branches, black caiman lay along the banks with flocks of black vultures scavenging on the gravel shoals. On disembarking we were introduced to our accommodation at the Wildlife Centre by being given a screw-top sweet jar and told to keep all soap and toothpaste securely in there. We were then sent off to individual, flying insect proof, but cane sided huts, with

candles for light, and comfortable mosquito netted beds, en suite (river water powered) shower, wash basin and flushable toilet and even electricity available for three hours a day but only in the main building, luxury indeed in the middle of the jungle. Cleaning my teeth by the light of a single candle, having retrieved my brush and paste from their jar, I then reached in to my toilet bag to take a statin tablet in true middle aged western man style. What I had not thought of was that, although I had stored my soap and toothpaste as advised, my toilet bag still smelled of soap, so that as my hand reached in to the bag in the virtual darkness of the hut, three separate creatures 3 – 4cm long ran up my arm and across my shoulders to drop on to the floor and scuttle away. Not quite my introduction to the wildlife I had expected, and a little disconcerting in the pitch black of the Amazon night, but cockroaches obviously thrived in their jungle stronghold.

This was certainly the place to see monkeys, usually high in the canopy, black capped squirrel monkeys, capuchin, red howler, black spider and saki monkeys, swung and sung above us, with other species there but unseen. By night, an hour's walk from camp was a comfortable hide with mattresses and mosquito nets fronting a low wet clay cliff, a clay lick for visiting tapirs, if you were lucky and stayed late enough – we stayed late and were lucky. After a late night, an early start by boat to visit some 7 – 10m high earth cliffs, more mineral supplement, but this time for macaws and other parrots. In their hundreds, as if in shifts, first to arrive were blue headed parrots, then orange cheeked, with some mealy and yellow-crowned parrots finally followed by hundreds of mainly red and green macaws. While we had an alfresco breakfast, a number of birds of prey circled at a respectful distance eyeing up these colourful avian mouthfuls.

The next experience was rafting across an oxbow lake, partly to look for my anticipated giant river otters. The giant Victoria water lily with its metre wide leaves, with the diminutive wattled jacana with oversized toes running over them; the raft silently passing within a metre of all but submerged black caiman; hoatzin were in the fringing trees as birds noted for their clumsy flight, uncertain, but

ancient ancestry and chicks with claws on two of their wing digits, but my giant otters were nowhere to be seen.

The Manú National Park is 1.5 million hectares, where the biological diversity is said to exceed anywhere else on earth and is now fully protected, but elsewhere, the Amazon basin is suffering from man's greedy destruction and its future is as uncertain as the future of the planet.

With unfinished business I needed an excuse to return to South America to find what to me had become the elusive giant otter. That excuse came when a conference was to take me to Manaus, a city of two million people, famous for its rubber boom affluence exemplified by the great Opera House in a city surrounded by jungle. A major "sea" port although it is 1,500km from the ocean, it lies at the confluence of the peaty brown Rio Negro and the paler Rio Solimões where they flow side by side as "the meeting of the waters" to form the Amazon proper. It is a great experience to sit outside your riverside hotel and look across a river so wide that you cannot see the far bank. I had hoped to see the pink Amazon dolphin but time overcame ambition, although it was exciting for me to see three-toed sloths, slothing their way through the trees on the city limits.

Although Manaus was my official objective, it was the last destination on my journey, as I entered Brazil via Rio de Janeiro and headed west and south before finally heading north. Rio, with six and a half million inhabitants, is everything it is cracked up to be, brash, possibly a little unsafe, but well worth a tourist style visit. Copacabana and Ipanema beaches were wide and sandy but were disappointingly almost deserted when I arrived; perhaps they had heard I was on my way! Where I might have expected seagulls back in Britain, the skies over these beaches had frigate birds and the view from the beaches to the backdrop of the city was always to Corcovado Mountain, with its enormous dominating statue of Christ the Redeemer. Near the statue, ever resourceful capuchin monkeys played on the kind hearts of tourists for titbits.

At the other must-do visitor attraction, the cable cars to the top of Sugarloaf Mountain at the entrance to the bay, the visitor begging niche was here occupied by wild marmosets.

Having been spoilt by the sight of near pristine Amazonian forest around Manu, the almost three hour flight west from Rio de Janeiro to Cuiaba, looks down on virtually continuous plant cover, but this time an almost uniform pale green, the natural vegetation here sacrificed to soya, a monoculture covering an area the equivalent of from the UK to the eastern Mediterranean. From Cuiaba, in Brazil's state of Mato Grosso, it is 100km on metalled roads to the town of Poconé, (worth a stop for an all you can eat lunch with half a dozen waiters serving different spit-roasted meats and serve yourself veg), from there you reach the 144km of the unmetalled Transpantaneira, a road that was once destined to completely cross and open up the world's largest internal wetland, the Pantanal, a name derived from pântano the Portuguese for swamp. This is a slow and dusty road for the wary; where you spread your hands on the windscreen with every passing car in case of flying road surface; look out for non road savvy wildlife and negotiate the more than 120 wooden plank bridges most of dubious quality and, on a good day reckon to average 20 – 30km per hour. Why would anyone put themselves through this unique driving experience? One reason is, that it is said that, "spend a day on the Transpantaneira and see more wildlife than a week in the Amazon". The 210,000km² Pantanal flood plain is fed by the Upper Paraguay River and is 80% submerged in the rainy season. Although the 1350km² of the Pantanal Matogrossense National Park is protected as a Ramsar site, 99% of the remaining land and its eight million cattle are privately owned, and the area is variously threatened by erosion, sedimentation and pollution from agriculture; hunting, poaching and smuggling of endangered animals; unsustainable commercial and sport fishing; infrastructural developments; uncontrolled tourism and, in parts, deforestation. The area is so big that these are not seen by the visitor as immediate threats. Indeed, to build the raised road of the Transpantaneira, material was dredged from either side leaving water filled

ditches and heavily vegetated pools, which even in the dry season do not dry out. As the waters recede much of the wildlife gravitates to these areas and as you first reach the road one of the first remarkable sights, of many to come, is of egrets and herons fishing from the 10m wide roadside wetland delimited by a continuous black line stretching on in to the distance, which, on closer inspection is composed of hundreds upon hundreds of caiman each up to two or three metres long, there are said to be ten million of them in the Pantanal but they pose no real threat to humans. Heading for our accommodation in a fazenda, a cattle ranch now geared for tourists, I ticked off the rare marsh deer, the biggest in South America, capybara the world's largest rodent, hawks and herons assorted and the fish, mollusc and amphibian eating jabiru storks, the tallest flying bird in South America with a 2.8m wingspan.

Under the trees around the fazenda, bird seed brings in a myriad variety of finches and other small birds, including the red-crested and yellow billed cardinals. Above them in the trees were regular visiting toco toucans, of Guinness advertisement fame, plus at least two other similar species of toucans and acari. A hummingbird patrols the flower border. A shout of "potoo" sent half a dozen of us following one of the ranch hands to a group of trees half a mile away, where frantic pointing at a "dead" branch revealed the motionless almost totally camouflaged body of this extraordinary bird. With 550 bird species listed for the Pantanal I still had a few to go. On our way back we pass an enormous very active jabiru stork nest with parrots nesting in the lower thickness of the nest. Along the river, caracara, predominantly scavenging birds of prey, hunt for food, a few ibis and snowy and great egrets examine the edges of the few remaining shallow pools. These ephemeral pools still contain a few freshwater crabs and around the edge the chicken egg sized snail shells, emptied mainly by the frequently seen snail kite, while the savanna hawk continues hunting over the open grassland. Along the river edge caiman from half to two metres long, sun themselves on the bank, but are not a threat to humans, either ignoring our approach or sliding back into the water. Disturbed capybara, as large as

Labrador dogs, plunge with maximum splashing into the river as if for effect, perhaps this discourages the caiman for which they are a regular meal. Kingfishers, swallows and half metre long iguanas also share the river bank. Some areas near the fazenda are paddocks bordered by post and wire fencing, but the posts look odd as many are entombed in one to two metre high termite mounds.

A mounted tour of the area takes our horses through knee deep mud as the land continues to dry out, and red and green and blue and yellow macaws appear and disappear but finally, as we near the end of our ride, one of the great specialities of the area, the hyacinth macaw lands in the tree ahead, well worth the saddle sores. That evening, a nighttime excursion by a four wheel drive vehicle armed with a spotlight, revealed some new species and a passing vehicle told us we were literally within a couple of minutes of seeing a jaguar remove a road casualty caiman from the track. We backtracked just in case and found the footprints of the jaguar and the drag marks of its prey, but to me, used to tracking but rarely seeing otters, this was still exciting.

Thinking of otters, wasn't this one of the main reasons for passing this way? True, so in to our boat and off down the river. The river was partially choked with water hyacinth making progress at times difficult and slow, but all the river creatures I had seen from the bank I could now see from their own environment. Eventually we stopped, and simple canes with two metres of fishing line and a hook were produced and baited with a fragment of an off cut of meat. Within seconds there was a tug on the line and out came our first 15 – 20cm piranha, unhooked by our boatman who also rebaited the hook, I dipped the line in the water, immediately another fish and so on until after ten or so we got bored, or the boatman had sufficient for his evening meal, and we stopped. But the silent boat and the fishing activity brought a bow wave through the water hyacinth beds and then a head emerged a few metres away – I had finally come face to face with the elusive giant river otter. Although I had not actually seen a jaguar or got

my hands on an anaconda, I was content having seen my giant and could prove it by having its photograph printed on my coffee mug.

Perhaps, one day, I might see the peatlands of Patagonia made red by the carpets of *Sphagnum magellanicum* a species which I have only seen as odd clumps on British peatlands but that is just ambition. There are a few other things in South America which my ecotouristing ventures have seen and found worthwhile. Having traveled in the west, north and centre of South America with its different peoples and wild country, arrival in Buenos Aires on the estuary of the Rio de la Plata, with a population of three million, 90% of whom are white, the home of the tango; “the Paris of South America”, feels more like arrival in a European city, with classical architecture and a city of parks and avenues. I tour the city and pass the Falkland Islands War Memorial to remind me who and where I am. From here I am flying to Iguazu Falls where this “wonder of the modern world” separates Argentina from Brazil. At 2.7km across and 80m high they are not the tallest or widest falls in the world but are often said to be possibly the most spectacular. The constant spray can be seen for many miles before you come in to land. The National Park which surrounds them is highly diverse tropical forest said to contain 2000 plant species, 400 bird and 80 species of mammals, but even without searching for them, the most likely to be seen are bands of South American coati, metre long (including tail) members of the raccoon family, who seem to make a living scrounging off visitors to the extent that many are now obese and suffer from diabetes. Within the rich flora of the wet forest, parrots move through the trees and armadillos snuffle their armoured way through the undergrowth. This is an area where nature earns the money which keeps the local economy afloat, and as in so many areas of mass tourism, a few hard pressed areas are easily offset by the protection this procures for vast areas off the tourist trail.

In a change of continents my interest in amphibians took me to a herpetological conference at the University in Stellenbosch, a predominantly Afrikaans town

some 50km east of Cape Town in South Africa. My recollections of the Halls of Residence at this university were honed by the fact that we arrived after midnight, on a cold winter's night, to the unheated Hall where they were unable to find bedding for my room, a cold night followed, but a good conference ensued. This is the only place I have been where gangs of people – conference delegates! - would wander round the town looking in shrubberies for the remarkably abundant, green and well camouflaged, chameleons. Whilst here I did attend an event where I could indulge my foreign food tasting propensity by eating small portions of much of the non-protected hoofed wildlife, but there were few other chances to interact with nature. Fortunately travels before and after the conference put me back on the eco-trail.

Cape Town is certainly not one where I could feel comfortable as a visitor, as the eyes of the less affluent seemed always to be on you, almost like a lion waiting for an animal to separate from the herd. Fortunately the local wildlife is a much more pleasurable experience. The jackass penguin colonies around the Cape are very approachable with trackways above them containing the visitors while the birds waddle between their nesting sites and the sea oblivious to the camera toting spectators. Less like a circus is the so-called, Cape Floristic Region, one of the world's hotspots for biodiversity. Key to this are the 9,000 higher plants of the region of which 69% are endemic, and the archetypal vegetation of the region is the fynbos. Fynbos is a fire prone Mediterranean type of shrubland often dominated by Proteas sometimes called sugarbushes. A place to see its own type of fynbos is in the Table Mountain National Park. Table Mountain itself is botanically exciting and the abundance of rock hyrax, the diminutive, thick set herbivores, which, perhaps unexpectedly, are relatives of the elephant, and the many reptiles make a visit worthwhile.

Like a minority of the human population, a minority of the wildlife have less than sociable intent. While entering a wildlife park near Cape Town to see eland and zebra, we were stopped at the park entrance as the pay booths and rangers'

offices were temporarily closed, and as we watched, a group of chacma baboons were systematically trashing any accessible areas of the whole building, a less than loveable character trait for this species. I was traveling with Kerry a research student of mine, and just before we left Cape Town we decided to visit an ethnic market dedicated to trinkets for visitors, but at this early hour we were the only visitors there. After a time half a dozen other white visitors arrived and someone called out "Kerry", it was a good friend from her school days who just happened to be in Cape Town and neither knew the other was there. The probability of that happening probably means that all is not lost in playing the National Lottery.

Not claiming geography to be my best subject, I thought that, as I was flying in to Cape Town via Johannesburg, I would only have to turn left, or would it be right, and I would be close to the Virunga Mountains of Rwanda and have an opportunity to see the gorillas for which I desire, like seeing the Royal Albatrosses of New Zealand, I blame David Attenborough and his close TV encounter with the species many years ago. In reality Rwanda was some 1600 miles north and nearly four hours flying time away, but to me a must do. I was slightly concerned that I was going to a country where, little more than a decade before, a million or more mainly ethnic Tutsi people were brutally killed by the Hutu majority. After crimes too horrendous to recount, both groups were now ostensibly living as a single nation.

In Kigali, the capital of Rwanda, there were relatively few foreign visitors, as most came to see the mountain gorillas, and only about 40-50 people per day in total were allowed to visit the seven habituated groups. Kerry and I, after being taken to the museum devoted to the genocide, and built over the graves of over 20,000 victims, decided to explore the living city after our visit to the necropolis. In Cape Town we both felt uneasy if we moved away from the safety of visitor numbers, but here in Kigali we were the only whites moving through the bustling city shops and markets. We did not feel uneasy, everyone here seemed to be welcoming and not seeing the visitor as a resource to be exploited. But, between

themselves, although everything on the surface seemed peaceful, I could not help thinking what was going on in the minds of people who had seen such wrongs committed by their erstwhile neighbours. Rwanda is one of the most densely populated countries on the planet. Literally every road in town or country is lined with people walking about their business, making it difficult to believe that in the not too distant hills there can be a population, albeit threatened, one of the most enigmatic creatures on the planet.

A couple of hours drive from Kigali takes you to Kinigi, on the edge of the 125km² Volcanoes National Park, the starting point to go watching gorillas. Each day a maximum of eight people were allowed to visit each of the then seven families of habituated mountain gorillas for just one hour, with a guide, armed guard and some porters to carry excess baggage and after paying a permit fee of several hundred US dollars. Before you set off, a 7am meeting divides visitors into groups and lays down the rules; no nearer than seven metres; no loud voices, no spitting or coughing, no finger pointing (gorillas know about guns), no direct eye contact; learn to make gorilla contact noises; pee before you enter the forest and if "toilet facilities" are subsequently required, there is a porter with a panga (a machete like knife) who will dig a hole for you and subsequently fill it in. We had the chance to see two groups of gorillas over two days. Some visitors opted for a short twenty minute walk to the nearest group, but we asked on the second day to visit the Susa group, the largest group of some forty individuals, but the hardest trek at some six hours and up to 3000m in altitude, first through gently sloping agricultural land then, beyond the National Park wall, we pushed through steep, thick bamboo forest in ankle deep mud and continuous thick drizzle. This group still had some individuals studied by Dian Fossey, perhaps best remembered by her portrayal by Sigourney Weaver in the film *Gorillas in the Mist*, and we were certainly looking for gorillas in the mist.

Above the bamboo forest we stop to see some of the many plants the animals eat, the celery-like one was quite edible, but I don't think I could not manage the

34kg per day eaten by an adult male, and there, in the clearing to my excitement, is a large and fibrous dropping, our first sign of gorillas – different things excite different people!. Trackers permanently follow the gorilla groups and keep in contact with our guide by radio. Soon we are following a 50cm wide forest path when suddenly the guide passes the whisper along the line “Stop!” Within seconds a half grown gorilla literally pushes past us on his track. The rain had just stopped and a black shape in the undergrowth is pointed out and this is a very wet, full grown gorilla. “What is she doing?” we ask, “She needs to warm up so is eating her own warm faeces” is the reply. We see the point, but do not think it will catch on in human society, although I have known a few dogs who

A young American woman embarrassingly asks for a man with a panga, and we move on. Leaving our armed guards (there in case of forest elephants or insurgents from Congo) and our porters and gorilla spotters, we drop as quietly as we can into the top of a shallow ravine full of mainly tall herbaceous vegetation and a some small trees, with a slightly more open area heading downhill where two small gorillas play fight for our entire visit. “Remember the rules” says our guide most of us already making our gorilla peace call, but immediately a middle aged American armed with a rocket launcher of a camera heads off towards the nearest male silver back, who probably weighs 220kg or some 35 stone, silver back doesn't appreciate him intruding on his personal space, beats his chest as he runs towards the now rapidly retreating cameraman and continues to run closely past the rest of the group. “Have you got the message?” the guide asks. Sitting quietly in the vegetation, watching thirty to forty wild gorillas that now completely ignore us as they eat, sleep, scratch and play, is a remarkable experience. Keeping our required seven metres away was not always easy as animals came and went close by. There was clearly some activity behind me in the low tree on which I was leaning and the activity got closer. Eventually leaves began to fall on my head, and less than a metre above me, a half grown gorilla was bending branches to make a couch, where he lay for the rest of our visit, clearly oblivious of “the rules”. The downside of being

exposed to visitors is the danger of disease particularly respiratory (hence no spitting and coughing) and diseases of the gut (hence the panga), as well as tuberculosis from domestic stock. Habitat loss, poaching, the consequences of war, such as new settlements, use as food and threats from land mines, and acceptance by local communities when they move beyond the boundary wall of the National Park into crop lands, are all real dangers to the then 480 animals in the Virunga. With some 22,000 visitors in 2013 mainly from Europe and North America, each paying a substantial price for their permits, we can but hope the animals are paying their way and that the hour a day which is paid for is conservation money well spent.

On from Africa to Asia. The Field Centre which I ran until it closed in 2010 was not the only one operated by the School of Biosciences at Cardiff University. The story goes that as a senior researcher was wandering, as you do, through the riverine dipterocarp forests along the Kinabatangan River in Sabah, Borneo, looking for Bornean elephant, when he came upon a new, but empty Field Station, accessible only by battling through the forest or by river. By collaborating with the Malaysian authorities and Sabah Wildlife Department the Danau Girang Field Station was brought back to life and is now an active research and teaching base. I went there before the first students arrived to offer my advice on aspects of running the Centre and how it might be used.

The trip was interesting. We arrived at Cardiff Airport on a Bank Holiday Monday. The previous Friday I had been in the Departmental Office excitedly explaining my forthcoming trip when the secretary said she had all the tickets in the office safe. "Can I take mine?" I half-jokingly asked. "Sure, here they are. Look after them!" I therefore arrived on the Monday tickets in hand. "You don't need those" said Mike "all e-tickets nowadays". He was wrong, and the Departmental Office was closed as it was Bank Holiday, so I headed to the departure lounge alone with just time to ask "What hotel am I expected at in Koto Kinabalu?" Three flights later I found the hotel and the following morning had my first Malaysian

breakfast of curry and black eggs – an experience, if not a total pleasure, although I could have had bacon and eggs had I not such an adventurous palate. From Koto Kinabalu I flew to Sandakan for the couple of hours' drive to the Kinabatangan River where I transferred to motorized canoe for the final leg of the journey. This is a remarkable place for its biodiversity. As part of the Lower Kinabatangan Floodplain Wildlife Sanctuary, orangutan, proboscis and long tailed macaque monkeys, Bornean gibbons and western tarsier represent the primates with clouded leopard, bearded pig, Bornean elephant and sun bear as some of the other larger if elusive mammals. Eight species of hornbill and 300 other bird species plus reptiles such as saltwater crocodile, water monitor lizard, reticulated python, king cobra and many amphibian and fish species, represent the rest of the vertebrate fauna. But it is not just a place for animals as the plants are equally diverse.

The first morning after the rest of the group finally arrived, we set up our mist nets to see what birds we could catch along the convenient forest glade created by the access path from the river to the Centre. After several decades of mist netting birds in Wales, this was slightly different. In places we set the net somewhat higher off the ground, where wild pig tracks crossed the net line and I was always concerned that the macaques, when crossing the glade, would drop down just a little bit too low and need disentangling from the net – untangling monkeys is not even mentioned in the BTO Bird Ringers' Manual! Although we could see few birds in the surrounding vegetation they soon appeared in the nets, three species of kingfisher in the first ten birds. Wearing my sweat-soaked, open neck shirt I returned to the Centre for a shower to find that dropping down from the trees above were mammal-seeking tiger leaches now firmly attached to my chest in the V of my open necked shirt. They were harmless and painless, in spite of the blood, and I proudly showed off my leach "scars" on my return home. Such leaches were common, and a young boy at the Centre showed me how to make them dance by waving a hand just above them, and when out in the forest,

an area flattened by sleeping wild pigs had several plump, blood-filled leaches hanging from nearby leaves, showing evidence of recent porcine occupation.

Orangutans regularly feed from a fig tree just outside a Centre building and elephants sometimes pay a visit, on one early occasion uprooting all the lighting posts along the access path, “they do not like anything new” I was told.

Out on a boat exploring the river, I saw hornbills, hawks, proboscis monkeys, salt water crocodile and monitor lizards, but , what probably pleased me most, was adding a new otter species, the smooth coated (or could it have been the almost extinct hairy nosed, I doubt it), to my list of otters seen. We pulled alongside the canoe of a local fisherman to see if there could be fresh fish on tonight’s menu, a few larger specimens were purchased, but among the scatter of smaller fish on the floor of the boat were species with which I was already familiar from the tropical aquarium days of my youth, such as the blue gourami and archer fish. Although probably over fished in the wild, one of the great delights of the river is the giant Malaysian river prawns or *Macrobrachium*, 30cm long including their claws, meaty and delicious.

Perhaps this sounds like an idyllic environment but it is more a gem within a mire of problems. The river was once home to the largetooth sawfish, probably extinct since the 1980s as well as the declining giant freshwater whip ray and red tailed gourami, together with several hundred other declining species. Runoff from palm oil plantations which now make up most of the Lower Kinabatangan Flood Plain, together with pollution from the processing mills which has changed the river chemistry, and the associated deforestation, which has led to soil erosion and sedimentation, all contribute to a loss of aquatic biodiversity. To these factors can be added over fishing of declining stocks, invasive species, and a lack of enforcement of environmental regulations. The great forests which once covered the areas are now palm oil plantations, and the remaining forests are essentially river fringing strips, with not infrequent breaks in continuity. Driving

back to Sandakan, the road passes through endless kilometres of palm oil plantation. The roads are relatively quiet, but every few minutes we encounter a massive tanker, which in the UK would carry road fuel, but here ferries out palm oil to feed the world's demand for a very dubiously green product.

Situated between Africa and America I have taken a long term interest in the mid-Atlantic Islands stretching from the Azores, some 500 miles off the coast of Portugal then via Madeira, the Canary Islands and south to the Cape Verde Islands. The latter came elsewhere into this story but the other islands are deserving of mention. Other than holidaying in the Canary Islands my "tour" of the Atlantic Islands began in Madeira where I told a conference about my concerns relating to invasive animals being introduced to island habitats. It was, however, the fact that one of the major visitor attractions on the island was sledging through steep streets in a wicker basket combined with a five storey wicker work sales outlet to service the local basket willow industry that really caught my eye. Willow weaving was brought to the island in Victorian times as a pastime for the wealthy British who went there to recover from tuberculosis. This introduction to the craft willow industry was the original direct impetus for my subsequent research work on craft willow production in Wales which was an important research area for me at Llysdinam in my later years there.

My contribution to a conference in the Azores more specifically related to dangers from invasive Louisiana red swamp crayfish which have now spread in Mediterranean Europe, Africa and now form the basis of a massive industry in China. The potential problem in the Azores was that they only have a few lakes and these contain a whole raft of island specific endemic species, particularly snails, and red swamp crayfish are particularly fond of snails as a source of calcium. Sadly in the few months prior to the conference these crayfish had been found in these lakes so I, in association with chemical ecologists in Cardiff, instigated a proposed EU funded project to try to control them using pheromones, that is, chemicals to attract them to one point for capture. The local

university was interested in the work but it did not sufficiently impress the funders to provide the cash. Although the islands are one of the best areas in the world to see whales and dolphins a lot of their other biodiversity is under threat. Limpets are a delicacy to the extent that they are now difficult to find due to over collecting but probably more seriously, the rich endemic flora of the uplands has been destroyed by the planting of vast tracts of *Cryptomeria* forests.

At least on some of the smaller Canary Islands, particularly La Gomera, significant tracts of laurisilva forests and its endemic flora and fauna have been preserved but the sustainable line fishing tuna fleet of a couple of decades ago seems to have been replaced by a “pirate” fleet of cetacean chasing tourist boats ultimately driving away the whales and dolphins on which they base their living. But, where hydrofoils have not taken over, it is still a joy to watch flying fish rise over the bow waves of the old style ferries as they chug their way between the islands.

Destroying natural habitats for more productive crops is not limited to the palm oils of Indonesia or the destruction of the Amazonian forests, but can be seen in the tax break fueled destruction of the moorlands by planting conifers in Wales in the 1970s or even the loss of endemic rich upland vegetation by alien *Cryptomeria japonica* forests in the islands of the Azores. As the song says “When will they ever learn, when will they ever learn”.

8. Mid-Wales – Yesterday, Today and Tomorrow

Nothing stays the same for ever and the countryside is no exception. I have known Wales and Newbridge-on-Wye in particular, for over four decades and have seen many changes. Over a still longer time frame even more changes have clearly taken place, but some things just fade unnoticed into the continuum of time, whilst others leave a more obvious mark to be seen by succeeding generations. Sometimes, items we identify as new have always been there but overlooked by our inobservant selves but all form part of countryside history.

A local example of a story preserved subtly in the landscape is that of the historic river crossing of the Wye at Newbridge-on-Wye. Newbridge is one of the few nucleated villages in mid Powys and has probably been a crossing point between Radnorshire and Brecknock as long as men have wished to cross the river. The evidence of this longevity lies, in part, in the number of drovers' public houses, which for a few hundred years almost characterised the village, marking its importance as a west – east crossing point for herds and flocks and gaggles, as well as in its horse fairs and markets, which drew people from all points of the compass. However, looking further back in time, certainly before the bridges (and today's bridge is at least the third), there is evidence of a river crossing written in the landscape and growing by the roadsides. The present road, the B4358 from Newbridge to Beulah, crosses the Wye bridge and soon heads up the steep Estyn Pitch, but, in days before the river plain was drained and the Estyn Brook was bridged, the mud of what was probably an alder swamp, the rocky river crossing, and the steep onward gradient would have defeated road traffic of the time and necessitated a drier route.

Just upstream of the modern bridge an old trackway brings you from the village to the river and a slang (a strip of common ground) between the river and fenced fields, where once drovers' cattle could be left overnight. Where the old trackway reaches the river, looking straight across towards Llysdinam House, behind

which was the Field Centre, you can detect, especially on a frosty morning, a zigzag grassy track going up the hill. In many parts of Britain ridgeways kept travellers to the drier hill tops, and here in Mid Wales things were probably much the same and my zigzag track towards Llysdinam led on to an existing hedged road running east well above the valley, a ridgeway in effect if not in name.

It has long been recognised that the more species of trees and shrubs a hedge contains then the older it is likely to be. Work in the 1970s, in eastern England, suggested that every extra tree or shrub species which a hedge contains adds one hundred years to its age. More recent work questions the precision of such numbers but the principle of more species meaning greater age still holds true. I often got students to count and identify the tree and shrub species in hedges in the area on the basis that more species means greater age. The most diverse hedges, with a maximum of at least thirteen plus species of tree and shrub per 30m of hedge, were in the first 400m from the top of the zigzag along the ridge. Even if we do not take the 1970s age interpretation of at least 1300 years literally, I believe that these are incontrovertibly VERY old hedges and that their natural history suggests that this was an original route east – west to and from the village. After some 400m the old track continued over open ground, past two farms before turning sharply south along a still existing wide grassy track, probably a drove route, to rejoin the present road at the top of the Estyn Pitch, thus avoiding the alder swamp and the steep gradient, the old road then continued west past the very ancient Llanafan Church and the Red Lion Inn.

But, in whatever ways the Wye has been crossed at Newbridge over time, the overall appearance of the river from the bridge has probably remained, at least superficially, unchanged for centuries. So, does our perception of a river as essentially unchanging over time reflect reality? Unfortunately the answer is 'No' as there are often changes that take place unseen literally below the surface, so that perception may not reflect reality.

The story of natural history in mid-Wales has a touch of serendipity, combining the River Wye and its surrounding hills and woodlands with the influx of aristocratic and moneyed families to establish protective sporting estates along its course. This has been followed, over the years, by the consequences of the breakdown of many of these same estates and the continued search for exploitable natural resources, in mid-Wales, particularly water.

It's a long time ago since the rivers teemed with salmon, but when I first arrived in mid-Wales some over four decades ago, I knew an excellent naturalist and photographer Harold McSweeney (Mac) who himself lived in the Edw valley for at least a couple of decades and he, in his early days, knew a man, then still living in the Ithon Valley, whose grandfather lived in the valley in a small cottage claimed from common land as a Ty Unnos, a house built overnight giving the builder the right to that small patch of land. The cottage was essentially one room but with an enormous fireplace, constructed, so the story goes, to enable the occupants to smoke salmon caught in the river, as without this source of food the family, through poverty, would have starved during the winter. To take this story on, two brothers, the Selwyns, who owned a fishing tackle shop in Llandrindod Wells from before the second world war, would tell the story of the demise of the Ithon's salmon fishery as a result of post-war afforestation and agricultural land improvement. These both combined to silt up the salmon spawning beds, until the spawning runs of the species almost ceased. In this case it is verbal history which has given us the baseline against which to judge change.

To these causes of salmon decline can be added air pollution, acidification of the water, the increased use of agrochemicals which destroyed their invertebrate food, and the over-exploitation of salmon at sea, drastically reducing the returning breeding stock. With the loss of salmon has gone the loss of native crayfish and freshwater pearl mussels for similar environmental reasons.

The Ithon, with its stories of declining salmon stocks, enters the Wye just below Newbridge and drains a relatively nutrient rich catchment east of the Wye, but the Wye has another major tributary the Irfon, which enters the main river at Builth, having flowed from the nutrient poor uplands of the Cambrian Mountains to the west. Over the post-war decades the Irfon has also lost much of its aquatic and related fauna also largely due to acidification from afforestation. This happened because ploughing the wet upland peats to plant the trees, aerates the soils and increases the acidity of runoff water; the chemical compounds in coniferous leaf litter are naturally acidic and the evergreen leaves of conifers accumulate the acidic particles from polluted air to be washed off when of heavy rain follows dry periods and these in combination produce very acidic results.

In the decades from the 1960s to the end of the century, the waters of the Ithon became one hundred times more acidic, turning from around pH6 to a vinegar-like pH4 (pH is a log scale so that each pH number is ten times that of the next). Acidification causes aluminium in the clays to dissolve to the extent that they become toxic to invertebrate life, so the tops of the food chain such as fish, including of course salmon and trout, as well as dippers and otters were starved of a food supply and so declined. Indeed dippers reduced to a tenth of their pre-forestry numbers. Fortunately, over the early years of this century work has been done by the Wye & Usk Foundation and Cardiff University which has helped reverse this trend. As air pollution has decreased due to legislative control, regular liming of the upland catchments by these organisations has reduced the acidity and some normality seems to be steadily returning to the river, but the river and its scenic beauty may have appeared unchanged in spite of the biological turbulence below the surface.

In about the 1830s a new farming and sporting estate on the banks of the Wye at Llysdinam was established and bought by the Rev Venables and later, through marriage, it became part of the estates of a wealthy industrial and landowning family the Dillwyn Llewellyns from the Penllergaer Estates in Swansea. Just

upstream at Doldowlod, James Watt, of steam engine fame, had likewise bought a large estate centred on the river. Upstream and downstream the wealth of the country put the river's banks into protective custody, also maintaining a patchwork of small woodlands for shooting, all policed by game keepers. The incoming wealth also changed the social and economic structure of the area as common lands were enclosed for agriculture and the displaced inhabitants were found work on these new estates as the servants of the rich.

The family who had bought Llysdinam had thus acquired a 300 fish beat (i.e. the expected annual catch of salmon) but that grand annual total for salmon catch from this stretch of the Wye has dwindled until, in some recent years, it has been little more than one hundredth of 300 benchmark and now all caught salmon have had to be released in order to protect stocks. By artificial breeding, habitat improvement and some control of marine exploitation of this migratory species, the stocks of salmon may now gradually be improving, but nature's bounty of years gone by has undoubtedly been consigned to be a footnote in history.

It was In the Elan Valley, On the Radnorshire/Brecknock border, Birmingham Corporation built, and opened in 1904, its first four reservoirs to supply that city with water. A further reservoir, Claerwen, was constructed almost half a century later. There are some very good descriptions of the valley prior to the flooding and no doubt there were spawning runs of salmon into the headwaters. Looking at these original dams today, visitors admire their physical beauty and the flow of clean, if sometimes peat-stained, sparkling water, released over the rocks at their base, some perhaps thinking that here is a bit of the original stream, little changed from the nineteenth century. How wrong can this perception be? In fact, the clear, sparkling water hides a secret. As it emerges from the cold and airless bottom of the dam, it rapidly becomes oxygenated in the fresh air, which chemically oxidises the salts dissolved in the water, particularly salts of iron and manganese, and precipitates them out as an often rusty sludge which is unsuitable for freshwater life. Therefore, if invertebrates are sampled from near

the outflows from the dams and compared with similar samples from the unconstrained Wye above Rhayader, the abundance of life in the latter proves that not every sparkling stream carries the same amount of life. It is worth emphasising that the water is good and perfectly drinkable, it is just the sediment near the dam which is the problem.

To bring these reservoirs into the twentieth century and perhaps to look ahead into the twenty-first, there was a proposal in the 1970s to increase the size of Craig Goch, the uppermost Elan reservoir, to make it the largest area of man-made open water in Western Europe. These plans and their potential consequences have been described elsewhere. Although shelved, they have been dusted down at least once in the last couple of decades, but will they be allowed to crumble in to the dust of time?

Freshwater pearl mussels were once fairly common animals in clean, fast flowing, low calcium, largely upland streams and rivers throughout much of the UK. To harvest these freshwater pearls is said to be one of the reasons why the Romans came to Britain. Today, certainly in Wales, they are restricted to just a few locations. At one time the River Wye was noted for a freshwater pearl mussel population measured in hundreds of thousands, probably millions, of individuals. A survey of the Wye in the 1990s measured the remaining population in tens. Then in 2012 a small population of some 500 individuals, now the second largest remaining population in Wales, was discovered in the lower five kilometres of the River Irfon near its confluence with the Wye. This gives at least a glimmer of hope in a bleak situation.

So why have pearl mussels declined? The first cause of their decline was largely itinerant pearl hunters, who would remove hundreds or thousands of mussels from the river, open the shells in the hope of finding the very occasional pearl and then discard to the bank the now dead animals. In recent decades salmon and trout have also undergone massive declines in their natural populations,

effectively breaking the life cycle of the pearl mussel at the point where it needs to attach to a fish. If that were not sufficient, agrochemicals from pesticides to fertilizers, the use of which increased in the post-war years and which end up in watercourses, are as toxic to freshwater pearl mussels as they are to other forms of life. Post-war forestry and agricultural intensification have clogged the gravels of many rivers with sediment, to the detriment of these animals of clean water. Because of their longevity measured in decades they have no doubt filtered from the water and stored in their bodies chemicals which have long been banned from use, such as DDT, dieldrin and PCBs.

Until the 1980s, many of the tributaries of the Wye downstream of Builth Wells were full of native crayfish, but these animals are now hard to find due to a combination of silt, plague and pyrethroids. As a result native crayfish threaten to become functionally extinct in the UK in the next couple of decades. Natural Resources Wales at their Cynrig Hatchery are now rearing native crayfish (and freshwater pearl mussels) for release into streams from which they have been lost. However, just how 'native' our native crayfish are is subject to debate, as we suspect they were introduced as monastic food to streams near religious houses 500 to 1,000 years ago, and in addition Theophilus Jones in his *A History of the County of Brecknock* (1805) records translocations of crayfish between wealthy estates in the county in the 1700s thus muddying the waters of what can be regarded as natural distribution.

Until the middle of last century, the otter was a common and frequently hunted animal, but the number caught by hounds and observed on rivers rapidly declined, and indeed they became extinct in many parts of England and Wales, except in more remote areas such as west and Mid Wales, the Lake District and the south-west of England. The major causes of decline were pesticides such as aldrin and dieldrin, which were used as treatment for seeds and as general insecticides. These washed into our rivers, accumulated in the food chain and eventually reached the top of this chain – otters in aquatic environments and

birds of prey in terrestrial environments – causing disruption of their reproductive systems and inevitable population decline. As a crude measure of animal abundance, the Llysdimam Field Centre stored any road-casualty otters found in Wales in its deep freeze prior to their post-mortem, and in the 1970s and 1980s none or one or two a year were generally sent to us. After these and other pesticides were banned, the reproductive block was lifted and the population of otters increased. Now they are found on virtually all streams in Radnorshire and throughout the rest of England and Wales; some populations now even exploit our coastal areas. The Cardiff Otter Project, the current incarnation of my 1970s deep freeze, now receives annually several hundred road-casualty Otters from England and Wales. Both perception and reality say the otter has returned!

Birds of prey such as the red kite and peregrine falcon have fared just as well, and their populations rose in the early twenty-first century from near extinction in the 1960s and 1970s to abundance, at least in the case of the kite, and to most available habitat being filled in the case of the peregrine, all without recourse in Wales to artificial introductions.

The decline in well known and commercially important species such as salmon and eels is likely to be noticed by fishermen, but changes to non-commercial species such as crayfish can easily go unnoticed. Some species, such as the freshwater sponge, common in the main river in the 1970s but now difficult to find, are even less likely to be noticed, except by biologists specifically looking for such things. But as one species disappears others appear for the first time, one such is the alga known, very descriptively, as water net, which was first seen along the main river in the drought years of the late 1970s, probably due to increased phosphates from detergents in the low flows of that year.

A very obvious species that has appeared on our rivers since the 1970s is the fish-eating goosander, which causes much debate about the extent to which it is involved in salmon decline. A less contentious bird species, which has spread

over Radnorshire as it has over the rest of the UK in the last few decades, is the collared dove. Unrelated to the dove's appearance has been the disappearance in the 1980s of the woodlark from its last Mid Wales locality, Builth Quarry, after a century of Mid Wales decline, although there are now signs of a modest recovery elsewhere but not yet in its old haunts. Now largely restricted to the Western Isles of Scotland, the corncrake was common a century ago, and is remembered from Newbridge-on-Wye fields and as a glass-cased specimen killed by a train near Llandrindod, as well as a common quarry of the guns of Llysdimam when they shot over their estate lands on the Mynydd Epynt between the First and Second World Wars.

One bird that increased during the twentieth century, but is in lower numbers in the twenty-first, is the pied flycatcher, a small black and white migratory woodland bird of western Britain which, it appears, just cannot resist a nest box in the right place! Sir Charles Venables Llewellyn first put up a few nest boxes on the Llysdimam estate in 1911 and monitored them until at least the mid 1930s. After that, largely due to the Second World War, the record is lost until the 1950s, when his son Sir Michael continued the study. The boxes were subsequently taken over by the Llysdimam Field Centre, which expanded the study and at one time operated 1000 nest boxes. Had the early records not been lost in the Second World War, this would have been the longest run of nest box data in Britain and perhaps anywhere in the world. Woodlands tend have limited numbers of holes for nesting, and these need to be distributed amongst a range of birds, such as blue tit, great tit, coal tit, marsh tit but rarely, nuthatch, redstart and wren as well as pied flycatchers. But where boxes have been provided the pied flycatcher population has expanded, often to fill almost all the boxes provided, at least until its twenty-first century decline. Many studies of this species have been undertaken in and around Radnorshire and published in learned journals, but in recent years the species seems to be declining, particularly in its marginal habitats, probably due to reasons beyond our shores.

It does seem to be responding to climate change as, over the last three decades, its first egg date has been getting earlier.

The pied flycatcher seems to prefer the insect-rich sessile oak woodlands of upland Wales, which usually due to sheep grazing are very open and have little or no understorey. While this is good for the flycatcher it is not such good news for the woodlands themselves. At one time, most were regularly coppiced to provide fencing, fuel for lead mines and fencing stakes for farms. Coppicing, that process of regular cutback that rejuvenated the trees, has long stopped and it is unlikely that its reintroduction would be successful after such a long gap. These old trees are gnarled and picturesque but in the twilight of their days, and the woodlands themselves are doomed unless regeneration occurs within the next few decades. Regeneration, no matter how it occurs, requires the exclusion of sheep from the area until any new trees are tall enough to be out of their grazing zone. Fencing alone may not be enough and active planting is likely to be necessary in most cases.

The wooded Radnorshire landscape in earlier times was often thought worthy of note by contemporary writers. William Gilpin wrote of his journey along the Wye in 1770, praising the wooded beauty of the Upper Wye Gorge from Llyswen to Builth as possibly exceeding that of the lower gorge. Although it is still a beautiful area, clues to the extent of the earlier wooded hillsides can be found on scattered rocky valley outcrops where occasional wild service trees still survive, isolated specimens of plants that began life under an ancient woodland canopy. In the Edw Valley the Rev Augustin Ley (1842 – 1911), co-author with Purchas of *A Flora of Herefordshire* and with a rare whitebeam named after him, noted the abundance of bird cherry woodlands in the mid-Wye, whereas today the woodlands have tended to become isolated patches or hedgerow trees. Several writers also noted the wooded nature of the Breconshire Bluffs, those fingers of hills which poke south to the west of Newbridge-on-Wye and which today are largely bare of sessile oak cover. Indeed, within the last half century, the wooded

hillsides at the western end of the Bluffs were said to be the largest area of this type of woodland left in Mid Wales. Sadly, time, agriculture and quarrying have fragmented them and the perception of loss is the reality of change.

On the hillside slopes, there is often evidence for change in land use, sometimes in fields of bluebells which mark the sites of long felled deciduous woodlands, sometimes in the hillsides, dotted white in spring with the blossom of scattered hillside thorns. These trees, like the oaks, are not regenerating, largely due to grazing. They are often favoured nest sites of redstarts and used by tree pipits for singing posts, and the old crow's nest in the thorn nearest the top of the hill was always the place to look for the elusive merlin's nest. It is said that sheep have grazed the uplands between Strata Florida Abbey in Ceredigion and Radnorshire's Abbey Cwmhir for over a thousand years, so how have the hillside thorns survived? Into the nineteenth century farmers would plant gorse, known then as French furze, on the hills to give the sheep the opportunity for an early bite of the new shoots before they hardened and became inedible. Such bushes were accessible only around their edges, which left a centre protected from grazing where thorn seeds could germinate and grow beyond sheep-grazing height before the gorse itself died naturally after perhaps twenty years. Gorse is no longer planted and so it is now difficult for these hillside thorns to regenerate.

Without the centuries of grazing, the peaty uplands of the county might have looked somewhat different today. They do, however, serve several useful functions. Undisturbed, blanket peats act as a sponge, holding rainwater and releasing it in a steady flow, helping farmers to water their stock even through a dry summer. Peats play a major role in removing carbon from the atmosphere by preserving the remains of formerly photosynthetic plants as undecayed peat. The water from peatlands is nutrient-poor so it develops little algal growth, making it ideal for a public water supply. However, commercial forestry on these peaty uplands has had many adverse effects by changing the hydrology, decreasing biodiversity and increasing the acidity of runoff water

Over the last couple of decades these uplands have seen some other changes to their natural history. Birds such as golden plover and dunlin are no longer regular breeders and red grouse are now scarce, whereas the scavenging red kite, which was counted in single digits in the UK in the mid-twentieth century, is now the most abundant raptor in much of its natural Welsh range. Over-grazing in the post-war period has turned many of the uplands from heather to bilberry to grass, again to the detriment of the wildlife. There are now schemes in various parts of the Mid Wales uplands to reverse coniferisation, block up drainage channels and reduce grazing pressure to improve water quality, trap carbon and increase biodiversity.

Taking a step further back in time we can open the pages of history preserved below our peat bogs. Because of its acidity and lack of oxygen, peat is a great preserver, and stories of bog bodies, well preserved over thousands of years, are well known. None, however, seems to have been discovered in my part of mid-Wales, the nearest being a nineteenth-century record from Tregaron Bog in Ceredigion. Under many of the blanket peats of the Elan and nearby valleys, peat erosion exposes trunks of ancient trees which suggest a forested landscape prior to the development of the blanket of peat some 3,000 years ago. However, the smallest plant remains provide a far more detailed record of natural history change as spores and pollen grains are the most decay-resistant parts of plants. Some 11,000 years ago, when the ice retreated at the end of the last Ice Age, Mid Wales re-emerged from its icy blanket generally free of vegetation. The subsequent vegetational history has been followed in the deposits at two National Nature Reserves in Radnorshire, Rhosgoch Bog near Painscastle and Cors y Llyn near Newbridge-on-Wye, both originally lakes but now nationally important peatlands. David D. Bartley published his studies on Rhosgoch in 1960; French and Moore reported on Cors y Llyn in 1986. Through its preserved pollen Rhosgoch shows the typical progression after the ice first retreated, over ten millennia ago, from open herb-rich grasslands, to a landscape of birch and

pine – the birch initially being the dwarf species still common in northern Europe. Hazel later became very common and formed extensive woodlands reminiscent of parts of the Burren in western Ireland today. By about 8,000 years ago our more familiar forest trees such as oak and elm and alder had arrived and the forests remained intact until Neolithic man began felling them, when we see a decline in tree pollen and an increase in the pollen of crops and weeds of cultivation such as cereal and plantain respectively. Unlike Rhosgoch, where the lake filled first with lake sediment then developed peat, at Cors y Llyn, after some lake sediment had accumulated, the vegetation grew out like a blanket over the open water and formed a quaking bog or schwingmoor. In these deposits French and Moore found hop pollen from the Roman period, which suggests brewing beer, and also flax pollen, which suggests the edge of the site may, in the long gone past, have been used for retting flax for making linen cloth.

Returning to the present, it has been said that almost all the changes that have taken place in the countryside over the last three decades can directly or indirectly be linked to the change from spring-sown to autumn-sown cereals and the change from hay to silage as winter food for stock. The change in cereal cultivation has eliminated the stubbles which fed many of our now declining farmland birds over winter, and the intensive use of insecticides and herbicides on these crops have further reduced potential food sources for wildlife. Highly productive, short rotation grass leys for silage have replaced the later harvested, herb-rich hay crops, which had the advantage that farmland birds could breed and flowers could seed before harvest while low chemical input maintained diversity. Into the 1970s groups of villagers would cooperatively till half a field with a local farmer and there plant vegetables to be shared between them. In winter these areas were covered with a stubble of weeds of cultivation and attracted flocks of small seed eating birds such as various finches, redpolls and yellowhammers and were the training grounds where I first taught trainees to mist net, process and ring birds prior to them being licenced to undertake their own studies.

Search as you may in a modern pasture it is often difficult to find more than half a dozen species of plants, usually dominated by ryegrass and clover plus a few weeds. Compare that to the few remaining herb-rich pastures in the Elan Valley or around Cors y Llyn where you will find in excess of a hundred species of higher plants, each with their associated insects, other invertebrates or even species-specific fungi. Some species such as yellow rattle, red bartsia, eyebright, and lousewort are hemi-parasites, green and photosynthetic but tapping into a host's rooting system, often a grass. There may also be twayblade, heath-spotted and butterfly orchids and characteristic old meadow species such as wood bitter-vetch, meadow thistle, saw-wort, dyer's greenweed, petty whin and globe flower providing the area with a bonanza of biodiversity.

The subterranean yellow ant frequently builds its anthills in such fields, and such mounds are habitats in their own right and often have different vegetation on their sunny and shaded sides and even, due to rabbit droppings, on their tops. Other areas which we might call old grasslands are perhaps less obvious, and these are the tightly grazed uplands on mineral soils which are mimicked in lawns, particularly those of old mansions, where the grass is constantly removed by mowing and little or no fertilizer or pesticide use takes place. Here the colour of autumn comes from the multicoloured waxcap fungi. At really good sites there can be ten or more species, in colours ranging from bright red to the pink of the ballerina waxcap through to yellows, greens and grey. These species not only brighten up an autumn day, but remind us how much of our wildlife we never see because it lies below the surface and unless it fruits we will probably never know it is there. Most soil fungi very rarely or never produce above-ground fruiting bodies but may be associated with the roots of higher plants, enabling them to utilise the soil nutrients, and, ironically, in wet, anaerobic peat bogs, even to access water!

Some things seem new simply because they have not aroused the interest of passers by. To the east of the Wye, Radnorshire has some rather special uplands, flat, less acidic than the western hills because of insufficient rainfall to develop much if any peat. From the Maelienydd and Beacon Hill in the north to the Begwyns in the south these uplands have their own structural interest and beauty, but what makes them particularly special to the biologist, is their ponds. Throughout much of this area there are shallow, often short-lived or ephemeral ponds which dry up annually or at least every few years. The nearest area of structurally similar ponds is in the New Forest and with them we share the nationally scarce pillwort, which is a grass-like fern producing lentil-sized black spore bodies – the “pills” of its name - and which lives typically in the stock-trampled edges of these ephemeral ponds. Also in these ponds, as in the New Forest, we have the fairy shrimp, an almost transparent, one centimetre-long creature, which swims on its back, surviving in some of the very short-lived ponds and even vehicle ruts. It relies for its dispersal on being blown as eggs to new sites when ponds dry to dust, although I suspect that motorbikes using the dry ponds as skid pans may now be responsible for some transference. When we have seen deep lakes at such places as Rhosgoch National Nature Reserve or Cors y Llyn fill in over time to provide a peaty history, shallow ponds may be thought very temporary features of the landscape, but this is far from true. It is possible that these ephemeral ponds do not fill in because, with regular drying, any vegetation will die, dry and blow away together with any other accumulated debris, returning the pond, on its next refilling, to its pristine uncolonised condition. This suggests that the shallowest ponds might be some of the oldest of our landscape features.

Not a pond but a small artificial lake, Llandrindod Wells Lake has a history of change. Constructed in Victorian times over a small peatland, it continued generally unchanged until, for whatever reason, a large quantity of superphosphate was added some decades ago, which swamped the lake with nutrients and destroyed most of the life. The lake recovered as the nutrients

became trapped in the sediment, but an annual algal bloom, which caused much largely unjustified concern, and was probably related to this enrichment. To the casual onlooker this green scum was at the least unsightly and at its worst said to be highly toxic, but to the biologist it was fascinating, as it contained an alga never recorded before in Britain and a planktonic animal, a species of rotifer, previously recorded only in Italy. Here the beauty of a bloom was certainly in the eye of the beholder

The lake became known in the 1970s for its large common toad breeding population. The toads still breed here, but in smaller numbers. One possible reason for their decline could be that in the 1970s and 1980s the lake was populated by bream and carp, fed, we found, largely on the ground bait added by fishermen and the bread provided by visitors for the ducks. (At that time there was no aquatic weed and so no swans to feed.) But subsequently, carnivorous perch were added, which no doubt fed and still feed, on toad tadpoles as well as other fish. Two other species which were also in the lake, but may have been destroyed by the dredging of recent years, were abundant swan mussels, thin shelled and the size of a glasses case, and the sprat-sized bitterling. At its only location in Wales, this fish lays its eggs in the swan mussel via the female bitterling's long tube-like ovipositor, a fascinating, if unseen, collaboration of nature. Along with many largely urban lakes and ponds throughout Britain, this lake changed in the aftermath of the Ninja turtle craze. A couple of decades ago saw children, who wanted to own their own version of the cartoon characters, buy fifty-pence piece sized red-eared terrapins. Time and regular feeding saw them eventually grow to the size of small dinner plates and they were then quietly, if illegally, released into the nearest water body! They are now in Llandrindod Lake and probably eating even more toad tadpoles, but their numbers are low and they are thought to be unable to breed in our present climate. In Roath Park Lake in Cardiff and Cosmeston Lakes near Penarth, both in South Wales, there are known to be hundreds of virtually uncatchable adult 'Ninjas'.

In the last few years another amphibian, the midwife toad, the male of which carries its eggs on its back, has appeared in and around Llandrindod. It possibly originally hitched a lift on purchased pond plants, but now its characteristic peep can be heard on summer evenings from Llandrindod to Howey and on towards Newbridge. It is a noisy neighbour but will probably not cause great problems. Here is a real change in the region's fauna caused by an obvious introduction. However, in the 1970s distribution maps of many species including amphibians were produced at a one dot per ten kilometre scale, and gave the perception that, except for Montgomeryshire, there were almost no great crested newts or smooth newts in Wales: they showed only three dots for common toads within fifty kilometres of Llandrindod and even common frogs were relatively scarce. This perception was certainly not the reality and all these species have subsequently been recognised as relatively common. Indeed after handling some 10,000 newts at Newbridge-on-Wye we found the first British record of a male smooth-palmate newt hybrid plus a second a few years later. The more you look the more you find!

The perception and reality for many invasive species are exactly the same. Yes, Japanese knotweed is a common and invasive weed. Yes, our riverbanks are being damaged by dense stands of the colourful if undesirable Himalayan balsam. Yes, our pools and ponds are being invaded New Zealand pygmy-weed, a plant that chokes out native flora and fauna, is almost impossible to destroy and is in some of our special upland pools from the Maelienydd to the Begwyns and on into Brecknock. Giant hogweed has been reported from Radnorshire, but has as far as possible been hunted down and destroyed consequently it is rare and best left untouched as it often causes skin irritation. Who knows what will be the next botanical curse on our countryside.

The Canada goose is another species which has increased in numbers over the last two decades originally only common at lakes at Llangorse and Penybont but

is now present on most available ponds. From geese to oaks, anyone regularly noticing acorns might well have noted the appearance of some with shiny, contorted Knopper galls transforming them, caused, like many galls, by the plant's response to insect attack. Other recent insect invasions have been the horse chestnut leaf miners, which can occur in vast numbers and which leave few if any leaves without their translucent cavities between the upper and lower leaf surfaces. Trees and shrubs have been subject to many pests and diseases over the last few decades: first it was Dutch elm disease; then it was the turn of alder, oak, rhododendrons and other members of the heather family, and then larch to suffer fungal attack. At the time of writing, ash dieback has been reported from Radnorshire, although the infected trees were rapidly removed from a roadside planting south of Newbridge-on-Wye, but what of the future? But not all invasives are a problem: for example, the New Zealand willowherb, a small, often overlooked plant of wild places, together with a host of other innocuous visitors do not appear to be any cause for concern and some may well become useful additions to our increasingly ethnically diverse botanical landscape.

With natural history some changes are very obvious, while others are more subtle and may go unnoticed, giving the false impression of an unchanging scene. There is, however, a further sort of change; a change in understanding due to the discovery of new species in the area through observation or improving technology. In the early 1980s a group of students from London came to the Llysdyman Field Centre at Newbridge-on-Wye in the first week of their first year at University and were given the task of identifying freshwater invertebrates from the Hirnant Brook, which flows down a valley in the Brecon Bluffs, just west of Newbridge. We expected mistakes from such novices, so the declaration 'I've found an *Asellus cavaticus*' [the cave hog-louse], which we "knew" was found only in the cave systems of southern Brecknock, was clearly an error – or so we thought! But no, this eyeless, colourless inhabitant of total darkness, an aquatic relative of the woodlouse, was in the sorting tray. We then found that a new bridge was being constructed upstream of our collection site and that this species

lives not only in the darkness of caves but also deep in the sunless gravels of the stream bed. Another discovery, this time just fifty metres within the eastern boundary of Radnorshire, was first identified by Ray Woods in 1975 and was probably the only distinct new species of native plant to be discovered in England and Wales in the last century. This plant was *Gagea bohemica*, soon named the Radnor lily. It was found amongst a handful of other national rarities on the well botanised slopes of Stanner Rocks. It had remained undiscovered because of its infrequent and very early flowering (usually around February before most botanists botanise) and because its leaves could, to the casual observer, be mistaken for sheep's fescue grass. The botanical expertise and diligence of Ray Woods, culminating in the publication in 1993 of his Flora of Radnorshire, literally put on the map many higher and lower plants of the county that would otherwise have gone unnoticed.

Technology has come to the aid of the discoverer. Camera traps are now in widespread use, particularly for elusive species in remote locations, (was it a pine marten we photographed near Llanwrthwl before inadvertent deletion of the shot by an over enthusiastic student?) and techniques such as bird ringing have taught us an enormous amount about bird longevity, behaviour and particularly migration. Bats are one group of animals that have always been difficult to study because of their nocturnal habits and sometimes almost inaccessible roost sites. But, over recent years, bat detectors, which make ultrasonic bat calls audible, have developed to the extent that they allow us to identify virtually all bats from their calls and to play these calls in woodlands to attract into traps for identification and release, species of bat which would otherwise go undetected. In south-east Wales it has been successfully used to attract Bechstein's bats. Such technology has enabled us to separate common from soprano pipistrelle bats and certainly increased our knowledge of lesser horseshoe and barbastelle bat distribution in the area, but these species may have always been there and needed the development of the technology to confirm their presence. Certainly the first barbastelles recorded in Radnorshire were taken as specimens from Llanellwedd

Church a century ago, but then came the long silence until the bat detector and the recording of winter roosts re-found them.

The reality of wildlife change across Wales was formalised by the publication of 'State of Nature (Wales) 2013'. This reported that of twenty-five species of butterfly in Wales thirteen have decreased; 57% of Wales's flowering plants are in decline and of the 1,467 flowering plant species ever recorded in Wales thirty-eight are now extinct and 17% are threatened. To this we can add that many farmland species of bird are declining rapidly and, overall, between 1970 and 1990 twice as many bird species suffered contractions in their range as those which increased their range.

It is against this background that you may ask 'What about the future?' We have seen that some species, such as the otter and red kite, have recovered in recent decades from near extinction to relative abundance without recourse to reintroduction, and with some help with habitat, or simply patience, other now scarce species such as the harvest mouse, dormouse and pine marten could again fill their respective ecological niches in mid-Wales without captive breeding and releases. I fear for our woodlands in a few decades time, for those that have survived the ravages of man are now threatened by fungi and insects and nature itself. Harvesting the wind for energy on our hills causes great rifts in opinion, but on the positive side some vast conifer plantations, planted by the rich for little more than offsetting tax, will probably be felled and the peatlands drained for their planting will be reinstated to actively growing peat bogs, which trap carbon and add diversity. Many of the drier post-plantation areas will be reinstated with typical dwarf shrub heath of heather and bilberry, albeit with wind turbines above them.

Agriculture will continue to change and new crops will be planted: some, such as short rotation coppice willow, *Miscanthus* grass and reed canary grass will be grown for immediate combustion or conversion to liquid fuel. Because they

require little fertilizer or pesticide and, are left to stand over winter providing cover, they are crops rich in wildlife, The coppiced willow acts as continuous young forest and attracts both small mammals and breeding birds such as warblers and reed buntings. In winter many of the declining seed-eating farmland birds come to feed on arable weed seeds, which wildlife-sensitive management can encourage between coppice rotations. Early indications from our own research show that the energy grasses are particularly good for encouraging small mammals, including harvest mouse and water shrew, as well as for providing winter roosts and summer nest sites for many small birds. This demonstrates that novel crops need not be detrimental to wildlife. The countryside will almost certainly continue to change with agricultural fashion and the changing financial moods of the European Union, and it would be a brave pundit, let alone biologist, who would predict how!

9. For Those Who Want To Find Out More

Now that Cardiff University's Llysdyman Field Centre is now no more, its work and the people who produced that work will quickly fade to anecdote and memory. In order to enable anyone in future to delve into the archive, I thought that a list of the Centre's publications would at least give a starting point for anyone undertaking such a search. Good luck and happy reading!

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