



Red dust rises

If you want evidence that global warming is happening, you need only look to China. Unseen by the rest of the world, much of the north of the country is turning into a land of droughts, dust storms and deserted villages. Mark Lynas reports



Tiananmen Square was almost empty. Only one or two intrepid cyclists pedalled along its northern edge past the Forbidden City, where Chairman Mao stares down impassively from his fading revolutionary portrait.

It was spring 2002, and Beijing was suffering another of its increasingly frequent 'dust days'. Close up, the dust was almost invisible, making its presence felt mainly as an irritating dryness at the back of the throat. But in the distance the whole skyline was blotted out by the dirty red-orange haze, and even at midday the sun threw only faint shadows onto the concrete pavements. Water lorries plied up and down the main thoroughfares, spraying water onto the street surface in an effort to keep down the dust, but the rising wind kept blowing swirls of it off building sites and around the deserted street corners.

Most of the dust in the air over Beijing that day hadn't come from unwashed streets; it had blown in from Inner Mongolia and the other drought-scarred provinces of north China. Every spring fierce winds lash these arid upland plains, whipping up swathes of dust hundreds of miles wide that roar down onto the Chinese lowlands and often reach as far as Korea and Japan, and occasionally even cross the Pacific and cast a shadow over America's Rocky Mountains.

Many scientists have linked China's spreading deserts, worsening droughts and killer dust storms to the impacts of global warming, and one of my main aims in visiting the country was to learn more about how likely this was. But I also wanted to experience the situation in the affected areas, and to speak to the people who lived there. This would mean travelling north into some of the least visited areas of China – at the height of the dust storm season.

Duolun, Inner Mongolia

'You are very tall,' were Su Yi's first words when he joined me at the bus station of the busy Beijing suburb. A researcher working with China's Desertification Institute, he was in his 30s, and had black hair, big glasses and something of a sense of humour. 'I think you are looking very English today,' he went on with a cheerful smile.

We left Beijing via a congested dual carriageway lined with poplars, and headed north towards the Inner Mongolian grasslands that border the immense Gobi Desert. The road led first through the Yan Shan mountains, their slopes steep and craggy, their soaring peaks lost in the distant haze. As the bus began to climb, the Great Wall itself came into view: traversing sheer mountain ridges, it was guarded intermittently by crumbling watchtowers perched precariously on each successive peak. On the rocky slopes fruit trees blossomed with pink and white flowers.

Further on, the terrain flattened out, the mountains suddenly giving way to farmland. Despite the hot sun, people were hard at work, digging up maize roots with broad, flat spades and

preparing the earth for the next crop. In smaller plots nearby, neat green squares of spring onions were well established, each bed surrounded by little ridges of soil to guide irrigation water around the plants. The narrow road was swarming with schoolchildren on bicycles, and as we neared a small town a platoon of soldiers from the People's Liberation Army jogged by in their green uniforms.

Then we were back in another range of mountains, climbing up towards a pass that led in turn onto an enormous plateau of dusty grassland – my first glimpse of the high Inner Mongolian plain. It was vast, with low brown hills massing row upon row towards the horizon, grazed only by a sprinkling of sheep and criss-crossed by gullies and eroded watercourses. Behind the occasional wall, sand had gathered in stealthy drifts.

Black winds

It was well after dark when a twinkling of lights on the wide plain announced our arrival in Duolun. The Duolun County forestry bureau director Sun Ming Shan was waiting. Before taking us out to his

favourite restaurant, he ushered us into the only hotel allowed to accept outsiders ('pointed unit for foreign tourist,' a polished brass plate declared on an outside wall). The restaurant was basic, with a concrete floor and stoves with long pipes to heat the room. It was still chilly, and everyone kept their coats on.

The meal was a succession of the sort of animal off-cuts that people in England assiduously avoid or hide in things like sausages. Pig tongue was followed by backbone and sliced ear, the latter disconcertingly crunchy. Feet and stomach were also included, accompanied by a variety of rather more appetising vegetable dishes. Sun ordered a bottle of strong rice wine, which we drank in little ceramic tea-cups to a chorus of '*gambei*' – Chinese for 'bottoms up'.

'There's a dust storm on the way very soon,' said Sun with an enigmatic smile. 'Have you brought a mask? Here it can get very bad.' I noticed that the windowsills outside the restaurant had little piles of dust in the corners, the legacy of a storm two weeks before.

These north Chinese plains have been doubly hit by drought and desertification in the last few decades, and severe dust storms are on the increase. Indeed, dust hazes such as the one affecting Beijing on

the day I arrived would hardly even merit a mention in these northern provinces. They suffer a much worse danger – the so-called 'black wind': the strongest type of dust storms.

Black wind storms are more than a nuisance: they are killers. When one tore through the provinces of Xinjiang, Gansu and Inner Mongolia on 5 May 1993 the authorities described the ensuing disaster as 'like an earthquake'. A total of 85 people were left dead, with 224 injured and a further 31 missing. Most of the victims were children out playing in the fields and unable to get home before the surging black and red clouds engulfed and choked them. Over 100,000 farm animals were lost, while enormous areas of crops were simply stripped of their leaves. Visibility was so bad that people spoke later of not even being able to see their hands in front of their faces. The hurricane-force wind was so strong that its sand-blasting action even eroded away the tops of tarred roads.

Although I was curious to experience a dust storm, I strongly hoped that the storm Sun was predicting would not be a 'black wind'. I had no wish to be caught in the middle of this desolate plain in a deadly sand-blasting tempest.

The next morning we drove out of

town, arriving before noon in a small adobe village called Yang Pangon, where Sun had arranged for us to spend a couple of days. The surroundings were desolate – just brown rolling hills with nothing but stones, dust and a few patches of dried-up scrub to break the monotony.

One of the first houses in the village belonged to Mr Dong, a wise-looking farmer with grey hair, brown trousers and a Chairman Mao cap, who smiled and nodded as we shook hands in the beaten-earth courtyard. Around us wandered several pigs, two cows, a puppy, lots of chickens and at least a dozen sheep, which all crowded around the water trough when Mr Dong pumped water up from a deep well. 'They get thirsty because there is no green grass to graze on the hills,' he told me, with Su Yi translating. 'All they can eat now is hay, and they're not allowed outside.'

I wandered round the village with Su Yi. It was peaceful, apart from the noise of the wind in the trees and the bleating of the animals. But outside the village it was clear that the sand was posing a major threat. All along the perimeter wall it had built up into big snow-like drifts, in some places burying the stone walls altogether. On the far side of the village, further sand drifts were several feet deep against the houses, forming graceful rippled dunes in the lee of trees, walls and gates.

A man was standing on one of the larger dunes – also wearing a blue Mao cap and traditional overalls – energetically shovelling sand away from a wall, which was perilously close to being knocked down. Although the sun shone weakly, the horizon was grey – rather like in Beijing – and gusts of wind whipped up clouds of dust from the dry ground all across the broad, featureless valley.

Back at Mr Dong's house, a crowd of kids had arrived to gawp at the strange new visitor. 'Hello, how are you?' a bold, scruffy one shouted. 'Thank you very mach!' They all collapsed into hysterical giggles.

At dinner I found out the reason for all the interest: I was, apparently, the first foreigner ever to have visited Yang Pangon. 'It's true,' Su Yi confirmed when



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I looked sceptical. 'Mr Dong says so, and he's lived here his whole life.'

To indicate just how isolated Yang Pagon is, that evening I tried and failed to find the BBC World Service on my short-wave radio. There was just a cacophony of hissing, metallic grating sounds and high-pitched whistles. I lay awake that night, Su Yi snoring next to me, both of us buried under blankets on the brick platform that doubled in the daytime as an eating table. Outside, the wind was still rising and one of the cows lowed inconsolably.

We spent much of the next day touring the local tree-planting sites, being conducted round like foreign dignitaries by the village Communist Party head. Saplings were being planted in trenches about three feet apart by teams of two, who would take turns to open the ground with a spade while the other popped in a sapling and tamped down the sandy soil around it. Dispiritingly, the whole area had only been planted the previous year, but because of the drought all the new saplings had died.

'This was once a wheat field,' Su Yi said to me, squatting down to scuff at some brown stubble in the ground. 'But the harvest failed, partly because of the drought and partly because all the best topsoil has already blown away.' He bent the top of one of last year's saplings. The dead twig snapped off easily.

As we walked, the wind raised clouds of dust like mist in front of the nearest houses. Already my eyes felt gritty and a coating of dirt came away when I rubbed my face with my hand. It looked like the promised dust storm was on the way.

By the time we returned to Mr Dong's house little dust whirlwinds were skittering around the yard and the sky had turned a sickly orange. After washing the morning's grime out of my eyes with a bowl of water, I ventured outside, walking back to the edge of the village in the fading light. All the surrounding hills had disappeared, and Yang Pagon seemed even more isolated in the threatening grey gloom. No one else was around – except for a small boy carrying a bundle of sticks, who warned me to return by pointing at me and then

Most of the 85 victims of a 1993 black wind storm were children unable to get home before the surging black and red clouds choked them. Over 100,000 farm animals were lost, and enormous areas of crops were simply stripped of their leaves.



at the village, before trotting quickly back towards the safety of the houses.

I hesitated, looking towards the windward direction in the northwest. The storm front was already approaching: a murky red cloud, difficult to distinguish in the fading light, but clearly heading towards me at a rapid pace. I managed to snap one photo before the first gust hit me, the sand stinging my face and neck. Suddenly dust was everywhere – in my mouth, ears, hair, eyes and lungs. Everything was red and all other noises drowned out by the colossal roaring of the wind. Coughing and hardly able to keep my eyes open, I fled back in the direction of Mr Dong's house.

Everyone was waiting on the doorstep, gesticulating at me to hurry as I opened the gate into the yard. Once I was inside the house, Mr Dong slammed the door firmly behind me and poured out a bowl of water for me to wash the sand out of my eyes. As I peered out of the window, the red sky became darker and darker, obscuring all light until it was impossible to see even a few feet across the yard. It was as if midnight had suddenly arrived in the early afternoon, eliminating all traces of day in just a few minutes. The storm even penetrated the house, filling the air with a fine dust like smoke, which settled in small piles around the cracks in the windows.

Unperturbed, Mrs Dong swept the dust off the windowsill into a bucket and

switched on the single naked electric light so that she could start serving lunch. Occasionally, the storm cleared slightly and the sky would be visible again through the surging red clouds sweeping across the valley. It was an odd sight – like being underwater and looking up at waves on the surface far above. A few drops of black rain spattered on the window.

Halfway through lunch there was a lull and a nearby stand of trees became visible again, but the next brown cloud was already gathering and rushing across the valley towards us, and in less than a minute it was suddenly even darker than before. I looked at my watch: 2.40pm. With the storm shut outside and Mrs Dong serving up bowls of steaming food, it felt almost cosy.

I asked Mr Dong how long this kind of storm had been happening. 'Twenty years ago the grass around here was knee-high. These storms only started in the 1990s, when the grass all dried up. Previously, we would have strong winds but no dust because the grass would hold the soil together.' Much of the problem was caused by overgrazing, he continued, but changing weather was aggravating the situation: 'This winter there was no snow at all, and the amount of rain is also decreasing. This spring was very bad – it only rained two or three times in total.'

With the storm still blowing outside, there was nothing to do except sit around talking and eating. With repeated choruses of *gambei*, we finished off another bottle of rice wine. By late afternoon the worst of the storm had passed, and the outline of the sun was visible again through the orange sky. Thinking that morning had come early, Mr Dong's cockerels began to crow.

The death of the Yellow River

As Mr Dong suggested, Chinese dust storms are part of a much bigger and more

intractable problem – drought. I had arrived in China in the middle of the worst drought in over a century; it affected the lives of millions of rural people and eventually cost the country \$1.2 billion in economic losses. But drought has been a problem in China for many decades now: as a result of gradual climate change and rising temperatures, the north of the country has simply been drying up.

This creeping disaster is illustrated by the fate of the Yellow River – one of the world's greatest rivers and the largest in China after the Yangtze. It runs right from the highlands of Tibet past the southern edge of the Inner Mongolian plain, and is a vital water supply for cities and crops throughout the entire region. Yet drought, combined with rapid economic development and industrialisation, nowadays often sucks the river dry. In 1997 it failed to reach the sea at all for 226 days, with no flow along as much as 700 kilometres of the riverbed. In June 2003 the government announced that the Yellow River's flow had reached its lowest level in half a century, leaving 12 per cent of the country's entire population short of water.

And every year, 2,500 square kilometres of China turns into desert; the land's sandy topsoil provides a ready source of sand and soil for the dust storms. Desertification is accelerating: its rate has almost doubled since the 1950s. Now there are sand dunes just 70 kilometres from Beijing. The number of dust storms affecting the country is increasing all the time. According to government figures, there were eight dust storms in the 1960s, 14 in the 1980s and 23 in the 1990s. In the year 2000 alone, seven dust storms roared through Beijing.

To experience some of more direct effects of the drought, I decided to travel to the western half of Inner Mongolia, where the desertification process is most extreme. I had heard reports of advancing sand dunes and disappearing lakes, but the information was sketchy at best, and very little of it has ever reached the international media. China's drought disaster is a forgotten one, taking place far away from the eyes of the outside world.



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Dongshen, Inner Mongolia

Reaching the western half of Inner Mongolia meant returning to Beijing, which was fortunate because I had to meet up with my interpreter – Beijing-based English teacher Liu Zexing. He was small and energetic, always impeccably dressed, and insisted that he was not the slightest bit put off by the thought of trekking through dusty deserts with his briefcase and polished shoes. We met for the first time at the main railway station, where he joined the shouting crowds in front of one of the ticket windows and eventually emerged – already slightly dishevelled – with two ‘hard sleeper’ tickets for the long overnight journey to Hohhot, Inner Mongolia's industrial capital.

The following morning revealed a familiar landscape: our train rumbled through desolate plains and arid rolling hills much like those I'd seen in my earlier trip to the eastern side of Inner Mongolia, 500 kilometres away. We crossed the Yellow River on a steel bridge – the river itself far below, sluggish and dirty brown in an immense flood plain of pebbles and mud. Then came Hohhot, an industrial wasteland of idle smokestacks and grim factory buildings. We spent as little time there as possible, changing to a

different train and then a bus that took us to Dongsheng.

We were met by the Mongolian director of the provincial forestry bureau, Mr Alatengbao, who told us that after three years of crippling drought the area had already suffered several big sandstorms that spring. ‘We've had drought before, but never as serious as this,’ he said over tea. The recent sandstorms had been terrible, he added. ‘It was like waves turning over and coming towards you, connecting the earth and the sky.’

Alatengbao was determined that I should appreciate some of the sights of the region, including the mausoleum of Genghis Khan, which was just a few miles out of town and the centre of a flourishing hero-worship cult devoted to the fearsome 11th-century warlord. Most of the ‘grassland’ surrounding the mausoleum had been turned to earth; it was covered in places by bits of drought-resistant scrub. A few green shoots were still pushing up through the ground, but the dominant colour was brown – not a rich, earthy brown, but the dry colour of baked clay, washed over not with greenery or with water but with patches of drifting orange sand.

Not far from the mausoleum was a

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bleak lakebed, bleached white by the sun. Nearby stood a set of dilapidated concrete buildings in mock-Mongolian style, a tourist complex that had been specially constructed for visitors to enjoy the lakeland scenery and wildlife. Now it was abandoned, the concrete and garish paint crumbling back into the surrounding sand. Slightly further on was a small village of adobe shacks, with a dozen or so cows and sheep tucked into wooden enclosures made of sticks. A single lonely boat – the only obvious reminder that this had once been the edge of a lake – was propped up against a dead tree, forlorn against the dry, dusty horizon.

‘This place is called Hong Hai Zai,’ our driver said. ‘It used to be a large area of water, but it dried up two years ago.’ The scene was bare and depressing, the overcast sky and cold wind completing the sense of desolation.

In the village a middle-aged herdsman in blue overalls was drawing water from a well. Our driver dug out a packet of cigarettes, and the herdsman took two, smoking one and putting the other in his pocket. It was the first time the lake had ever dried up, he told me. The whole area had seen no significant rain since 1997. ‘We used to catch fish and sell them in the market. It’s hard to believe now,’ he snorted contemptuously,

Sand dunes were piled up beside the road, spilling onto the tarmac. Barriers of poplar and willow trees had been planted as protection against the desertification, but in some places the trees had been buried right up to their crowns.

as the cold wind blew dust from the lakebed around our feet. For as long as the water lasted the grass at the lake edge grew well and provided ample grazing for the cattle, the man explained. ‘Now we are getting poorer. All the cattle can have to eat these days is dried-up corn stalks.’

The water level in the well was dropping too. It had gone dry the year before and would go dry again this year unless the rains came back. ‘This is the worst drought I have ever experienced,’ the herdsman said. ‘I heard from older people that there was a bad drought a long time ago, but it wasn’t as serious as this.’

As if on cue, the herdsman’s aged father shuffled towards us to join in the conversation. He also took a cigarette, and between puffs told us that the lake had shrunk once before – though without drying up completely. ‘That was in 1949,’ he said. ‘I’ve lived here all my life, and this is the worst ever. We’ve had no income for three years.’ He stopped to cough, hacking and spitting on the ground. Above us the branch of a dead tree creaked in the chilly breeze. Our driver lit up too, and the smoke from

the three cigarettes mingled, adding to the acrid smell of animal dung and ever-present dust.

Making our way back to the road, the car got stuck in the sand. Liu and I got out to push, straining against the back bumper. Liu’s blazer was looking rather dirty by the time we had freed the vehicle. ‘It’s OK,’ he said with a grin, brushing himself down and getting back inside.

We drove south for another 30 miles, nearly as far as the border with Shaanxi province. There were increasingly large sand dunes piling up on both sides of the road, sometimes spilling onto the tarmac itself – tangible evidence of advancing desert. Barriers of poplar and willow



trees had been planted as protection, but the dunes were pressing on regardless; in some places burying the trees right up to their crowns.

In one place a few acres of green pastureland still survived, but were hemmed in on three sides by the advancing dunes. As I walked around it, the contrast between the bright green grass and the orange sand reminded me strangely of a golf course. Once the sand moved over it, this grassland too would be gone – adding a few more acres to the new Inner Mongolian desert.

Two men were ploughing the dry soil, one leading a donkey while the other steered the steel plough behind. They spoke about the increasing sandstorms, and the struggle to survive without rain. I asked if anyone had lost land because of the advancing sand dunes. The ploughmen both nodded. 'Yes, we have,' one answered, pointing behind him. 'The sand dune has advanced so far that we can't plant anything. We have lost about 10 *mu* [over half a hectare] and a lot of income because of the sand.'

'Was it as bad as this 30 years ago?' I asked.

'Back then there was plenty of rain,'



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Mausoleum of Ghengis Khan

the second man answered, leaning on the donkey, which looked like it was glad of the break. 'It's always been sandy, but because of the drought it's now easier for the wind to move the sand. This drought is the worst anyone can remember.'

So what were they going to do?

One of them shrugged. 'The situation is bad, but we'll get by somehow.' His partner nodded stoically, patted the donkey, and the pair of them set off once again to continue ploughing what was left of their parched field.

More floods as well as more droughts

There is intense debate among the Chinese scientific community about the precise causes of the country's drought. The picture is complicated by increasing human pressure on the land: over-grazing and deforestation have both contributed to the current crisis. But two things are certain: temperatures are rising, and rainfall totals dropping. Climate change may only have tipped the balance, but large areas of northern China are becoming virtually uninhabitable.

For decades climate scientists have repeated the mantra that global warming means more droughts as well as more floods. There is increasing evidence from other drought-stricken parts of the world to bear this out.

One crucial factor in all this is heat. As continental interiors begin to heat up, more water is evaporated by plants and from the land surface. Drought results. So higher temperatures can cause drought even where rainfall totals remain unchanged. One recent study linked this effect with the severe 2002 drought in Australia, where low rainfall was exacerbated by soaring temperatures and rapid evaporation. Warming is likely to

accelerate in the future, and one computer model projection shows the continental interiors of North America, Europe and Central Asia up to a third drier by the middle of the century.

This process may have already begun in northern China. The 1990s were warmer than any other decade in the previous six centuries, and temperatures since the 1950s have shot up by 1.5° centigrade. These high temperatures have been drying out the soils in China, helping turn vast areas into desert and driving increasing numbers of people off the land. Computer models project rainfall increases of up to a fifth by 2050, but rises in temperature of up to 10 times. Northern China would get even drier still.

The other crucial factor causing drought is the atmosphere itself. The atmospheric processes that cause drought are the opposite of those that cause rain: rainfall is generated when air rises, which condenses water into clouds and generates precipitation; sinking air prevents cloud formation and stops rainfall. Global warming intensifies the hydrological cycle, with heavier rain in some places and at some times balanced by reductions elsewhere.

Strong evidence has emerged recently that links a major drought affecting everywhere from the southern US to central and southwest Asia between 1998 and 2002 to rising temperatures in the Indian Ocean. The mechanism is straightforward: warm seas triggered heavier rain in tropical regions, with sinking air causing drought in the mid-latitudes. Central Asia was one of the worst-affected regions.

Rainfall trends in northern China have indeed been declining. There have been measured reductions in both the number of rain days and the overall rainfall total over the past half-century. Conditions in the region now are even worse than in the very dry 1940s. Out of 12 recorded 'drought disasters' between 1949 and 1995, half occurred between 1986 and 1994. The 'drought disaster' that I was experiencing would turn out to be the worst of all.



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Wuwei, Gansu Province

Wuwei is one of the remotest cities in China. Stuck in a narrow corridor between high mountains and searing deserts, this ramshackle city of a million inhabitants attracts no tourists and hardly any foreigners. The main road out of Wuwei leads eventually to Urumqi, the capital of the restricted province of Xinjiang, where it splits into two; the southern section leading to Pakistan's Karakoram highway, and the northern branch finding its way to the border with Kazakhstan.

In the past its location as an oasis on the old Silk Road made Wuwei an important stopping point for trading caravans; Marco Polo would have passed through on his 13th-century voyage into China's Middle Kingdom. Now it's a neglected backwater, hemmed in on all sides by advancing deserts and with a steadily diminishing water supply from the area's rapidly disappearing rivers and lakes.

I had already seen graphic evidence of drought and desertification during the journey from Lanzhou, the capital of Gansu, 300 kilometres to the south. We

had left the city by car, accompanied by Dr Zhang, the director of the region's water bureau, who had described how the drought was affecting Gansu.

'You see all the hills there?' said Zhang as we made a way through a pass in which rows of peasants ploughed diligently between patches of thawing snow. 'They used to be green with grass. Now they're baked brown, as if they've gone bald.' This was the Hexi Corridor, one of the most sandstorm-battered areas in China. The Hexi Corridor is also a closed basin: its rivers are destined never to reach the sea, and traditionally peter out into huge salt flats in the desert. Now, many of those rivers don't even make it that far any more.

Zhang stopped the car just in front of a bridge not far from Wuwei, and we all got stiffly out. Below us was a dried-up riverbed, with not even a trickle of water left in it – just a broad expanse of gravel and rounded pebbles, which in some areas had been mined for road-stone, making the course of the old river barely perceptible.

'The water here used to be 100 metres wide,' Zhang announced. 'The river only runs for about 10 days a year now. It can go on a bit longer if there's a flood, but the longest recently was when it ran for a whole month back in 1996. There used to be six rivers in the Wuwei area, but now all of them are dried out.'

I asked what had taken the water away.

'We have a saying that in this region nine out of every 10 years brings drought. Now it's 10 years out of 10 years. It was especially bad between 1996 and 2001: there were six consecutive years of drought.' The situation has been exacerbated by the construction of reservoirs in the upper reaches of the rivers, and a rapid expansion of the population of the region's cities. In the 1950s Minqin, a smaller oasis town east of Wuwei, used to receive half a billion cubic metres of water a year. Now it gets only a fifth of that; the rest has been diverted to cities higher up, or has disappeared altogether.

Another aspect of global warming is also affecting the rivers. The western edge of Gansu province borders with the Tibetan Plateau, and the Qilian Mountains, which form the spine of the border, are the source of all the crucial oasis rivers. The glaciers in these mountains, which keep the rivers running all year round, are fast disappearing. Three quarters are known to be in full retreat, and half of all the glacier ice has disappeared in the last 150 years.

My main objective in Wuwei was to track down professor Liu Xinmin, the 60-year-old former director of Lanzhou's Desertification Research Institute. He knew the area intimately, and I hoped he could tell me more about how rapidly the deserts were encroaching – and why.

News of our arrival must have travelled fast. We were just unpacking in our small hotel room when professor Liu unexpectedly swept in, looking very dapper in his pork-pie hat and corduroy jacket.

The Hexi Corridor is a closed basin: its rivers never reach the sea, but traditionally peter out into huge salt flats in the desert. Now, many of those rivers don't even make it that far.

Like many Chinese people his age, professor Liu has been through a lot. The old Chinese curse 'may you live in interesting times' struck his generation perhaps more than any other. Banished from university to hard labour on a military farm during the Cultural Revolution at 26, professor Liu nevertheless managed to secretly learn English. The only reading matter officially allowed was Chairman Mao's *Little Red Book* of quotations, which the professor got to know entirely by heart. Professor Liu said: 'Mao said one thing that I still believe: "Serve the people". You should always serve the people, I think.'

This commitment has formed the basis of the professor's recent work, which focuses on the impact and – through methods such as tree planting and dune stabilisation – mitigation of desertification.

With groundwater disappearing so fast, the tree planting has been a mixed success, professor Liu told me. But his latest project – stopping sand dunes moving onto farmland by pouring asphalt all over them – seemed to have potential. To give us an example of this work, he took us that evening to a nearby site, where a rather shapely sand dune had been encased entirely in black pitch, which had been poured into hundreds of adjacent squares – each bordered with straw. The idea, the professor said, was that any rain that fell would soak through the pitch but would then be prevented from evaporating again, thus allowing plants to get a foothold. Professor Liu assured me that the worst pollutants had been removed from the pitch, and that it would biodegrade in five years, but I wasn't convinced. It really didn't look very nice – certainly not when compared to the graceful reddish curves of the surrounding dunes, some of which were 20 to 30 metres high.

But as Gansu's desertification crisis is becoming critical, aesthetics are very much a secondary concern. Not only are rivers drying up, but entire lakes have disappeared and people have been

deserting their villages – leaving whole areas of formerly productive farm and grazing land abandoned. In addition, ever more regular sandstorms are sweeping the entire area, and with each storm the surrounding deserts creep a little closer.

Man-made disaster

The following morning we were standing on the steps of the hotel, which fronted onto a potholed and rubbish-strewn side street, when our vehicle – a four-wheel-drive black and white jeep with a red light on the roof – arrived. Professor Liu was an influential man, and the local Communist Party had generously allowed us to use an official vehicle for our trip out into the deserts of Minqin.

'But that's a police car,' I said. 'Surely we can't travel around in a police car.'

'Don't worry, it's all arranged,' a grinning Zhang assured me. 'There are no tolls to pay in this, either.'

We piled into the jeep and began the journey out of Wuwei. Small tractors, piled with such enormous loads of hay that their drivers were almost completely buried in the middle, plied their way up and down the road. Long greenhouses lined the fields, which bustled with agricultural workers weeding, planting and watering crops. Yields in these oasis areas are some of the highest in China, professor Liu informed me, which is why it is so disastrous that the region's water supplies are gradually running out.

Much of the route to Minqin was blocked by roadworks, and we had to bump along in the desert – lurching from side to side in the rutted tracks. A few stunted bushes and pale clumps of dry grass were the only living vegetation. Everywhere else, in the areas no longer

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irrigated, the soil seemed to have given way to sand.

We stopped briefly at an enormous reservoir – the end of what remains of the Shiyang River. Again, I could see how the effects of drought had been worsened by misguided human intervention: the construction of this artificial lake had sounded the death knell for a natural lake further downstream and the wetlands that used to surround it, and it is there that the desertification problem is worst.

Minqin region is among the most badly desertified areas in the whole of China. In ancient times it attracted attention from the authorities on account of its 'abundant waters', 'fertile soil' and

Not far from Yang Pangon, a cluster of ruined walls were the only remains of a village once home to 500 residents. No international compensation came to the people displaced. Once their farmland dried up, they had little choice: migrate or starve.



'green pasture'. Now 94 per cent of it is desertifying, and sand dunes are encroaching at an average of five to 10 metres per year.

The deserts are nothing new, Zhang told me. What has changed is that they are now expanding so rapidly. Abruptly, he pointed out of the window at the big sand dunes on the left side of the road and then indicated towards some more dunes in the distance on the right. I could see them shimmering through the heat haze, squeezing the narrow green strip along the road in their relentless march. This was the spot where two of the biggest deserts are joining up, in a deadly pincer movement that is condemning the remaining oasis land around Minqin to gradually wither. Only about a kilometre of green land still separates the two deserts, and it will be overcome within the next few years. Then Minqin and its oases will be cut off, an isolated remnant of green in a spreading tide of sand.

We stopped in the town for lunch and tea, each cup served with an enormous lump of rock sugar poking out of the top. Professor Liu ordered pigeons for us all;

the small, skinny birds arrived plucked, gutted and boiled whole. Zhang demonstrated the correct way to eat them, delicately nibbling the skin off the head of his pigeon, then cracking open the skull like a nut and sucking out the brains. I couldn't bring myself to follow suit.

Back outside I noticed that the wind was rising steadily and that the sky had the same yellow-brown tinge I had seen before the storm in Duolun. Zhang had also noticed the change. 'Maybe it isn't the best idea to visit the lakebed when a dust storm could be coming. Are you sure you want to go?'

'Well, it's my only chance.' Professor Liu had told me that a village on the edge of the lake had been completely abandoned, and I was eager to see what the area looked like.

Back in the desert, sand was blowing across the road in winding orange streaks. On the left-hand side gnarled and stunted trees struggled to hold their own against the shifting sand.

'Those are Russian olive trees,' professor Liu said. 'They were planted here 20 years ago, but the water table has fallen

so much that they can no longer survive.' Some of the trees were already dead, their trunks half-buried in dry dunes. Others had just a few bits of foliage left on a couple of the higher branches.

The lakebed itself was even more desolate. Only a few small bushes offered any protection against the wind, and clouds of dust were already rising, whipped up from the flat expanse.

'This is Qingtu Lake,' shouted the professor over the wind. 'We're in the centre now. In the 1950s it was water here. Then in the 1960s and 1970s it was wetland. Now it's completely dry. But if you dig here you can sometimes find old watersnails.' My eyes were already stinging again with the dust and I had to return to the car to make notes, but professor Liu seemed completely unaffected – kneeling down to scratch a hole in the ground, searching determinedly for the long-dead snails.

On the near side of the former Qingtu Lake was the abandoned village, which professor Liu said had been prosperous before the deserts moved in. I had a look around the ruins. Bits of straw and twigs

were blowing around in circles in the remains of a front yard. The roofs had all collapsed, but some of the holes for washbasins remained, and in one house an old fireplace oven still stood. All around, dead and dying trees creaked in the gathering wind.

It was hard to believe that the community of several hundred people who once lived there had been turned into environmental refugees without anyone noticing. But not a single journalist had visited the village, and all anyone knew was that the former inhabitants had gone to join relatives or to eke out a living doing manual labour on the edge of the region's cities.

It was the same story in many villages throughout the area, professor Liu told me. Indeed, I had seen the same thing over 1,000 kilometres away in eastern Inner Mongolia. Not far from Yang Pagon, a cluster of ruined walls was all that was left of a village once home to 500 people. No international compensation came to the people displaced. Once their farmland dried up, they had little choice: migrate or starve.

But not everyone had left the desiccated edge of Qingtu Lake. One house remained inhabited. We knocked and hooted for some time before the wooden courtyard door was reluctantly opened by a middle-aged woman with two silver teeth. 'I thought you were the police!' she cried in a relieved voice after professor Liu explained the reason for our visit. Suddenly friendly, she invited us in. Chickens pecked around the neatly swept quadrangle, and barn doors swung and banged in the wind. On the far side of the courtyard was the house: a small, single-roomed building with a bed, cooker and hard sofa. Old Communist Party propaganda posters were plastered around the whitewashed walls inside, but apart from that the room was bare.

The woman, Ye Yinxin, had lived in the house ever since moving in with her new husband 30 years ago, when the surrounding areas were still productive wetlands. Everyone else had cleared out in 1998. Even the woman's husband had recently left, searching desperately for manual jobs in Inner Mongolia to bring

in some cash.

We all arranged ourselves around the room: professor Liu, Zhang and my interpreter perched on the edge of the bed, with me – the honoured guest – in the single chair, which was placed strategically in the middle of the floor. Mrs Ye stood, her calloused hands at her side. Rather tactlessly, I began by asking her whether she was lonely.

'Of course I'm lonely!' she answered fiercely. 'Can you imagine how boring this life is? I can't move, I can do nothing. I have no relatives, no friends and no money.'

I asked what life was like before the area turned into a dust bowl.

'I used to live a good life,' Mrs Ye replied, more softly. 'There were lots of people around and we all grew crops. People used to help each other out a lot, and we always had time to visit each other in the evenings.' She told me how the weather had changed: in the old days it had rained a lot, and water was plentiful; now there was continual drought, and when rain did fall no plants were left to soak it up, so it just evaporated away. She still kept a few sheep and cows, animals that were able to drink the saline water out of the well and eat brought-in hay. But for clean drinking water she now had to travel 12 kilometres in a tiny tractor to fill up a barrel.

'How long will you stay here?'

She laughed bitterly. 'Come back in five or 10 years and I'll still be here. There's nowhere for me to go.' Her parents lived about 30 kilometres away, but life there was only slightly better and they had no spare land. Her best hope was that her husband would get a good job and return with some money. But she hadn't seen him now for three months, and he had no way of sending word. Even her children had abandoned the home: both now lived in Minqin town, where the youngest was still at school, and neither of them could afford to visit.

Storm coming

Back on the other side of Minqin town more sand was blowing across the road, and I could tell that the storm would not

hold off much longer. Rows of poplars surrounding the nearby fields were thrashing around in the strengthening wind. Zhang peered out of the jeep's side window, looking concerned. Above us a bank of cloud was rolling in, blotting out the sun. It looked like a storm front: purplish higher up, but changing to red closer to the ground. We watched it move closer, the boiling red mass chasing across the fields towards us.

Everyone rolled up their windows and seconds later the storm slammed into the car, enveloping everything in a choking red mist. Visibility was suddenly down to less than 50 metres, and the wind was roaring all around. Other vehicles on the road switched their lights on and slowed down. In the fields people were packing up urgently. One old man had a coat wrapped around his head, and was struggling to get home against the strong wind. The workers from one of the road crews we'd passed earlier were crouched behind a stone wall, their shirts held up against their faces.

'This is the fifth dust storm in the region so far this year,' said Zhang sadly. Our driver switched on the flashing police lights, which lit up the dust all around us like a strobe light in a smoky nightclub. At one point I got out to take a photo, coughing and choking, my camera barely functioning and dust getting in my eyes, nose, mouth and hair.

As we drove past the big reservoir we'd visited earlier there was a lull. But on the other side the wind rose quickly back to gale force, reducing visibility to only about 20 metres. Sand was blowing in front with such force that in places the road itself was nearly invisible. There was a hissing sound as the sand blasted against the side of our vehicle.

As we headed back to Wuwei the wind roared louder still, killing any conversation, and we all watched silently as it blew the brown soils of China up into the air and away.

This article has been adapted from Mark Lynas's forthcoming book *High Tide: news from a warming world*, which is published by Flamingo next month www.marklynas.org