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Breeding ground

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The Three Gorges Dam has been dogged by controversy ever since it was mooted but the deadliest risk has barely been acknowledged. Steven Ribet investigates

Yang Jun is remembering what it was like here a year ago when his home town of Hanfeng was transformed into a quagmire of stinking black mud.

"Everywhere was covered. In some places it was nearly a meter deep," says Yang of the surprise flood that hit northern Chongqing's Kai county last September. "People were getting ill from colds and fevers. I had to walk around with a facemask on. Although the flood only lasted a day, it took us two weeks to clean up."

Yang, a taxi driver for the last 20 years, may not realize it yet but he could also be predicting the future of his hometown. Instead of a freak occurrence caused by flooding, stinking black mud could become a regular side-effect of flood prevention in Hanfeng once China's Three Gorges Dam Project is completed in four years, according to critics, including noted university environmentalist Lei Hengshun.

By then, Yang will have been relocated to a new city up the valley on the outskirts of what is now Hanfeng, but unless effective measures are taken, a 20km stretch of land curving around this urban area may become an environmental disaster zone for five months every year when high water levels recede leaving behind a festering bog of effluent, silt, industrial pollutants and rubbish, say experts.

The local government of Kai county has warned of epidemics that may spread across China. It is engaged in a race against time to build an auxiliary dam to save its population.

Elsewhere along the Three Gorges reservoir, other population centers may also fall victim to the Three Gorges "fluctuation zone" that is emerging as a serious future side-effect of the project caused by seasonal swings in water levels.

From the old Buddhist temple on the hill overlooking the city to the north, Hanfeng appears as a black sprawl beneath the low cloud cover of a wet summer. Three kilometers up the valley to the southwest, the pink and yellow apartment blocks of Kai New City are visible through the mist.

Further up, a forest of cranes marks the land along the upper reaches of the Pengxi River that is being dug for the new city's westward expansion.

Yang is one of those who will soon be relocated here, along with 120,000 other Hanfeng residents and additional families from other inundated areas.

To the southeast, the wide Pengxi is visible behind the grey rooftops of lower Hanfeng. From here, the tributary snakes down 60 kilometers of flat valley through some of the best agricultural land in Chongqing, before emptying into the mighty Yangtze river.

In summer 2009, as the project approaches completion, water will have been backing up along the Pengxi as its reservoir fluctuates near its summer height of 145 meters above sea level. That October, sluice gates far down the Yangtze will be bolted shut and the reservoir will rise to its winter height of 175 meters for optimal electricity generation. Water will continue backing up the twisting tributary, flooding the shallow valley downstream from Hanfeng, then Hanfeng itself and finally a long stretch of land running up the valley alongside the new city.

In May of the following year - and every May thereafter - the reservoir's water will be lowered again by 30 meters to forestall rainy season flooding. As the high tide subsides, Hanfeng and 4,600 hectares of land in Kai county will re-emerge, along with all the muck accumulated from seven months under water.

At Chongqing University's Department of Sustainable Development, Lei Hengshun reckons this yearly swing will alternately flood and expose more than 300 square kilometers of land around the periphery of the 660 kilometer-long reservoir and its tributaries.

Lei, a diminutive, grey haired octogenarian, says he first realized the gravity of the fluctuation zone in 1992, when he was reviewing the Three Gorges Project prior to voting on the issue as a delegate to the National Peoples' Congress.

"At the time there was enormous controversy over the project," Lei says. "Some delegates said all the problems it created could be solved. Others insisted more research was needed."

Over the following years, Lei did his own research. He conducted surveys along the entire length of the future reservoir. Affected land, he surmised, can be divided into two categories.

Around the Three Gorges valley itself the gradient is mostly steep. Seven months of soaking may loosen the rock and cause landslides. But in eight to 10 years these slopes will stabilize. Sediment, meanwhile, will slide back into the reservoir as the water recedes each May.

But where the land next to the water is flat or gently sloping this won't be the case.

In addition to Kai county (some 300 kilometers downriver from Chongqing city), Lei has identified neighboring Yunyang county and the city of Wanzhou further up as the areas most likely to be affected by the fluctuation zone. All lie along tributaries of the Yangtze.

When the reservoir rises and floods the shallow valleys of these auxiliary rivers, their polluted currents will become slow-moving or stagnant, forming areas of sludge and pools of filthy water left behind by the receding tide the following spring. These fetid waters will incubate in the heat

and humidity of summer to form optimal breeding grounds for flies, mosquitoes, bacteria and parasites.

Vegetation sprouting on this bog each summer will die and rot once submerged in October. And each winter this morass will release its poisons into the water of the reservoir.

In a less densely populated area, this might be manageable but central China's huge, crowded population makes not only for a heavily polluted river system, but also a potential crucible for pandemics.

Many of the 1.5 million people relocating for the reservoir are now building homes beside the high water line. In the case of Kai county, a pestilent swamp could soon appear right next to a city of 200,000 people.

Wind and insects will carry germs. Birds and other animals will move in and out of the swamp, and disease-causing agents with them. With so many people, says Lei, it will be impossible to stop humans entering the area.

"Once an emergency breaks out," he warns, "the consequences will be unthinkable."

The professor says his many warnings to Beijing went unheeded for a decade. Only in 2002 was a panel of experts appointed to look into ways of dealing with the fluctuation zone.

In March this year, meanwhile, the popular news magazine *Oriental Outlook* ran a story headlined: "Kai county in a State of Emergency." "If an ecological crisis breaks out," the magazine said, "Kai county will become an epidemic area. The widescale occurrence of infectious disease will be unavoidable."

The nightmare scenario, says Lei, is that the swamp's effluent could cause an as yet unknown disease to form. "Cases like the Sichuan swine fever are happening now because pollutants in the environment are causing bacteria and viruses to mutate," he says.

Last September's flash flood, which submerged much of Hanfeng and killed 85 people, was in many ways a dress rehearsal for tomorrow's emergency. After the deluge subsided, authorities had to spray disinfectant on the entire city after removing 9,000 tonnes of mud and rubbish accumulated after just a few hours under water.

Experts say spraying Kai county's entire 46 square kilometers of fluctuation zone would be far from viable - not just because of cost, but also because of the ground pollution chemical disinfectants would cause.

In 1999, Lei reported that the best way to tackle Kai's problem was to build a dam on the Pengxi. A modified version of his proposal is now being reviewed by the government and is likely to be fully approved soon for a site four kilometers downstream from Hanfeng.

This new "dam inside a dam" will be built to a height of 170 meters above sea level, creating a

permanent reservoir around Hanfeng and reducing the yearly fluctuation to a more manageable 5 meters. If effective, it will vastly reduce the area of submerged land that re-emerges each May.

Yet almost as if some endless chain of consequences were taking place, experts must assess the smaller project's environmental impact. Not only will the dam silt up the Pengxi, it will also call for a concerted campaign to reduce dumping and discharge upstream, lest a slower current results in yet another giant cesspool.

Higher water in flood season could also threaten Kai New City (at 180 meters) in the event of a repeat of last year's inundation. To counteract this, a 9km dyke will be piled up around the urban area. The total cost of these projects: 430 million yuan (HK\$413 million).

To add to the urgency, experts are warning that water from the Three Gorges reservoir could begin backing up to the proposed extra dam's construction site as early as next summer. For the necessary foundations to be in place by then, work must begin this October.

The success - or failure - of Kai's countermeasures will only be known once the county is flooded in 2009. Elsewhere, experts are still at a loss over what to do about the fluctuation zone.

Early on, the China Three Gorges Project Corporation looked into using the zone for agriculture or fish farming. If spring's receding waterline could herald happy herdsmen leading cows into new pastures, instead of a sea of black sludge, this might be reasonable. And pressure to gain some kind of commercial return still exists because the corporation has paid dearly for the land by forking out huge resettlement costs.

Nevertheless, the idea of farming is probably out. Aside from concerns over hazards to health, pesticides and fertilizers used to treat crops could leech into the reservoir once the soil is flooded. Aquaculture is also a big polluter and this has led most experts to decide against it.

To date, the best answer produced by the government-appointed team of experts seems to be a kind of local grass they hope won't die when submerged.

"It's called bamao grass and it grows in areas in Sichuan that are prone to flooding," says Wang Li'ao, head of environmental engineering planning at Chongqing University and a member of the team. "Even after months under water its roots don't die, and when the water subsides it continues growing very well. It will act to clean the zone."

Yet Wang also admits this grass may not survive below very deep water. It stands to reason. Nowhere in nature does there occur an annual waterline fluctuation equivalent to a nine-story building.

The best way to deal with the land, Wang reckons, will be to isolate it as an "ecological protection area."

This, she says, is progress. "I'm much more optimistic now than when we first started looking at the problem."

But Lei is far from sanguine: "It will be impossible to seal it off. Do you think we can build some kind of wall like the Israelis built in Palestine? There are just too many people here. Humans will always move towards water."

Back in Hanfeng, Yang is looking forward to his move. The government is assigning him a plot of land, he says, and it will be up to him and three new neighbors to use the compensation they are given to build a small house that will be more hygienic, with its own toilet instead of a communal latrine.

He is unfazed by the fears over the fluctuation area.

"China has already devoted so much energy to this project. We will certainly solve the problem," he says.

He'd better be right.