白乌溪流域的历代生态变迁
Historical Ecological Change in the Upper Baiwu Valley

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【摘要】
盐源县的白乌溪的上流
域是一个长期变迁适应人类使用的生态系
统。 1956年民主改革以来，生态的变迁加了
速，白乌地区遇到了一系列的“生态冲击
”，包括革命早期的 1957年的的居民点，大
跃进的森林大砍伐，稻米种的 60年代的失
败，和 1970年代在不合适的地点种植粮食与
第二次森林大刊发。

自从八十年代以来，多种经济作物已进入
盐源县白乌溪上流域的自然农业经济。重
要经济作物包括八十年代到九十年代中叶
的苹果， 1999年起的杂交玉米，和最近的经
济数量的花椒。本文分析这些作物对于劳
动结构，家户预算，当地市场，营养习惯
和地方生态的影响。

关键词：市场化 经济作物 生态 营养

Abstract
The Upper Baiwu Valley in Yanyuan County is an ecologoical and human system that has been changing and adapting to human use for hundreds of years. Since 1956, the pace of ecological change has speeded up, and a series of ecological shocks ecoshock have swept over the valley. These include, in the early years of the revolution, the gathering of residents into concentrated villages, cutting of forests during the Great Leap Forward, the adoption and then failure of rice agriculture in the 1960s, and the combined planting of grain on unsuitable lands and further cutting of forests in the 1970s. Since the 1980s, various cash crops have entered the formerly subsistence economy of the area. These include apples in the 1980s and early 1990s, hybrid corn since 1999, and recently huajiao in commercial quantities. The introduction of these crops has brought major changes in the structure of labor, household budgets, marketing, dietary habits, and local ecology for local residents.

Keywords: Marketization, cash crops, ecology, nutrition.

The Upper Watershed of the Baiwu River in Yanyuan County, Liangshan, in the southern part of Sichuan Province, has an area of about 38 km^2 and extends from an elevation of about 2550 meters on the valley floor, to over 3800 meters on the peaks of the Zala Mountain range. Natives of the watershed divide the natural environment into *ladda*, or valley bottom-land, *jjoba*, or low-lying bench-lands suitable for cultivation, and *hxobbu*, or mountains, ranging from the lower slopes next to the villages up to the peaks of the Zala range. The present inhabitants of the upper watershed are concentrated in two administrative villages, Baiwu and Mianba. The part of Baiwu Administrative Village that lies within the Upper Watershed consists of the village settlement clusters of Yangjuan and Pianshui, with about 80 households and 350 inhabitants each, and Zhuchang and Gangou, with 15 households and about 60 inhabitants each. All inhabitants of the valley belong to the Shynra dialect group of the Nuosu, an ethnic group of about two million people that is a branch of the officially designated Yi "nationality". The administrative village of Mianba lies entirely within the watershed, and consists of several natural villages with a population of several hundred people. Both Baiwu and Mianba Administrative Villages belong to Baiwu Township, Yanyuan County. Our research has been concentrated in the area belonging to Baiwu Administrative Village.

This paper attempts to trace the ecological changes that have occurred in the upper Baiwu Watershed since the early part of the 20th century, and particularly since the Democratic Reforms of the Chinese Revolution, which took place beginning in 1957. Through the last half century, in fact, the watershed has been beset by a series of human-caused "ecoshocks, ," unexpected, unpredictable, and ecologically damaging changes that have emerged from policy decisions made outside the watershed, and in which the inhabitants of the watershed have played a very small part. In this paper, we first describe the ecosystem as we understand it to have existed in the early part of the 20th century, then set out each of the ecoshocks that have occurred in the area, in each case showing its origin in policy decisions, the course of its implementation, the ways in which local residents have participated or resisted, and the ultimate ecological, economic, social, and nutritional effects. Finally, we make some modest proposals for future development that seek to avoid the detrimental effects of well-intentioned policy initiatives that unwittingly transformed themselves into ecosystem and social disasters.

Early Ecological and Human History of the Valley

No systematic archaeological excavations have been carried out in the Baiwu area, but it is likely that the area has been inhabited by Tibeto-Burman peoples for at least 2000 years. Although historical documentary research is fragmentary, it is reasonably certain that members of the Prmi ethnic group, whose descendants are classified as Zangzu in Sichuan, were the sole inhabitants of the valley until about 1780, when Nuosu migrating from across the Anning River in Xide and Puxiong areas began to enter the highland portions of the valley. They were lead by the *Nuo* (aristocratic) Loho clan, which brought with it *quho* (commoner) retainers from the Shama Qubi, Ddi, Ali, Hxi, Syte, and other clans,

as well as a large number of *mgajie* (serf) and *gaxy* (slave) dependents. When the Nuosu first settled in the immediate region, the region sat on the border between the domains of three *tusi* or local rulers: the Muli King with his headquarters at Wachang, the Ji *tusi* with his headquarters at Guabie, and the Lang *tubaihu* with his headquarters at Guboshu in Central Yanyuan. They farmed the river valleys intensively and cleared portions of the benchlands, probably for shifting cultivation. From about 1780 until after 1900, the Nuosu remained primarily in the mountains around the edges of the valley, above Gangou and in the Zala Mountain area. Probably due to a combination of population growth and changing political conditions,in about 1916 some Nuosu began to move from the hills above Gangou to the plains around Mianba, where they purchased land from some of the Prmi and cleared it for cultivation. By 1956, the land in both the *jjoba* and the *ladda* between the place where the Gangou river debouches onto the alluvial plain at Yangjuan, and the current site of the town of Baiwu, was owned in a patchwork by Prmi agents of the Muli *tusi*, who rented it to Prmi and immigrant Han peasants, and by *Nuoho* and *Quho* Nuosu. By 1950, Nuosu had displaced all the Prmi inhabitants of the valley above Baiwu town. They lived in a series of scattered clusters of housing all around the *jjoba*, farming lands both in the *jjoba* and the *ladda*, and pasturing their animals in the upper valley between Yangjuan and Gangou, as well as on the mountain slopes. Most of the *jjoba* and all of the mountain areas remained forested, probably in a mixed coniferous and deciduous forest consisting of pine, fir, rhododendron, oak, alder, and other species. Older residents recall a rich variety of vertebrate wildlife in these forests, including several species of wildcats, the occasional leopard, wolves, bears, and red pandas, as well as enough bird life to make the whole day into a symphony of bird calls. They grew the traditional crops of buckwheat, oats, corn and potatoes, and during the 1930s and 1940s engaged in some cultivation of opium for sale. Older inhabitants say that relations between the Prmi and Nuosu were sometimes peaceful and sometimes involved violent conflict, as did relations between various *nuoho* and *quho* clans in the area.

Prelude to ecoshocks: Democratic Reforms and Population Concentration

The Democratic Reforms came to the Baiwu area in 1957, bringing about an end to the slave- and serf-holding property systems of the Nuosu, as well as to the servitude regimes of the Prmi in the area. Such a reform of property and social relations had only minor ecological effects in its own right, but there were much greater effects of the Population Concentration (*jumin dian*) policy, which was carried out at the same time.

Before the *jumin dian*, Nuosu people lived scattered across the *jjoba* and the lower mountain slopes. But the authorities felt they needed closer control over what they considered a potentially unruly population, especially in light of the Nuosu revolt against the Democratic Reforms, which had one of its most important centers in Ninglang County just to the West of Yanyuan. In addition, they wanted to facilitate the implementation of various programs of socialist transformation and socialist construction. So they gathered all the inhabitants of the upper valley into two villages, Yangjuan and Pianshui.

The Loho, who were the overlords of the entire area, all left the Baiwu valley at the time of the Democratic Reforms, leaving their *quho* retainers and *mgajie* and *gaxy* serfs and slaves. Most of their *qunuo* retainers, belonging to the

prominent Mgebbu clan (a branch of the Shama Qubi) and the other clans with which it was intermarried, were grouped into one village at Yangjuan, together with a large portion of the serfs and slaves of the Mgebbu and its allied clans. We have estimated the total population of Yangjuan at the time of the reforms as about 80-100 people. The direct dependents of the Loho, on the other hand, were gathered up from around the various parts of the *jjoba* and lower mountain slopes, and organized into the village of Pianshui. Although Yangjuan and Pianshui lie side by side, with only about a 10-minute walk between them, their social character is very different. Yangjuan, dominated by the Mgebbu clan and its allies and former dependents, has been a relatively cohesive community, while Pianshui has had a hard time finding unity among groups of diverse origins. In addition, the interaction between the two communities is minimal except in the context of the Primary School built in Yangjuan in 2000, which is attended by residents of both villages. This lack of natural cohesion has inhibited cooperation and development in the valley, particularly at the time of the Cultural Revolution, when inhabitants of Pianshui were stirred to "class struggle" against the former slaveowning *qunuo* clans of Yangjuan.

After the founding of the villages of Yangjuan and Pianshui, many reforms and development projects were carried out by local governments and village residents. Many of these were beneficial, such as bringing additional *ladda* land into cultivation in the early 1980s, a road to the village in the 1970s, and the connection to the electricity grid in 1997, along with the general improvements in public health that were a characteristic of the CCP's socialist regime. But at the same time, many government initiatives were ecologically disruptive, in the forms of shocks or "tsunamis" that flowed over the village from the outside without warning. Some of these shocks had clearly negative and long-lasting after-effects; others had mixed outcomes or long-term results that are still not clear as of this writing. But all of them brought fundamental alteration in the ecological and human system. We can identify at least seven major or minor ecological shocks since 1957, including the Great Leap Forward, the introduction of rice cultivation, Taking Grain as the Key Link, the introduction of commercial apple production, the introduction of high-yielding hybrid corn, the introduction of commercial livestock-raising, and the beginning of significant labor migration. The remainder of this paper gives a brief introduction to each of these waves of change, and then presents a summary of the lessons to be learned from this piece of ecological history.

Ecoshock #1: The Great Leap Forward

Although People's Communes where not officially established in Yanyuan until 1962, already in 1958 the effects of China's overall policy radicalization were felt even in this area. Agriculture was collectivized soon after the Democratic Reforms and the Population Concentration policy, and in 1958 collective canteens were established, one of them on the site of the present Yangjuan School. Residents were forced to adopt agricultural techniques foreign to them and/or unsuitable to their high-mountain environment, and 6 residents of Yangjuan are reported to have starved to death during the 1959-60 period, after which the collective canteen system and the extreme communized agriculture were abolished.

Of more lasting impact, however, was the Great Leap Forward Policy of Large-Scale Iron and Steel Smelting (*da lian gangtie*). There was no smelter built in the immediate area, but smelters in areas closer to Yanyuan County Town needed fuel, and fuel was most easily supplied by the forests on the benchlands and lower mountain slopes surrounding the Yanyuan Basin, of which the Baiwu area was a part. At this time, the entire forested area of the Yangjuan-Mianba *jjoba* was logged bare, as were the slopes of the nearby mountains surrounding Mianba, Yangjuan, and Pianshui. The wood was shipped to the "backyard iron and steel mills" in more populated areas of the county, or used for construction projects on the outside. In the space of about two years, the forested benchland landscape was gone permanently, and the lower mountain slopes were denuded of their natural species-rich forests. Except for more mesic slopes and exposures, these denuded slopes grew back slowly to a single-species overstory forest of *Pinus yunnanensis*.

The ecological after-effects of this ecoshock were long-lasting. As everywhere in China, there was a demographic "bounce" after the mortality crisis of the Great Leap Forward, and sustained and fairly rapid population growth began in the 1960s and lasted until the mid-1990s. As a result, more and more lands needed to be brought under cultivation in order to feed the increasing population, and with more and more households, more livestock were raised as well. This meant that the forested areas of the *jjoba*, cut in the late 1950s, have never been allowed to regrow, and the entire area is now given over to low-productivity cropland growing buckwheat, potatoes, and oats, which is nevertheless a crucial component of the food supply for residents of the valley. In particular, Mianba has no *ladda* land at all, and so must depend entirely on dryland crops.

The lower slopes of the mountains, unlike the *jjoba,* were not cultivated permanently, though the lowest part of these was briefly given over to grain cultivation in the 1970s (see below). But the effects on these areas were no less severe. First, with the initial cutting, the soil protection in the watershed was eliminated, and thus began the creation of large and dangerous erosion gullies particularly near the courses of the many streams that run out of the mountains. The climate of the area is such that over 70% of the annual precipitation falls in the four-month period between June and September, and in large storms as much as 100mm of rain can fall in a 24-hour period. When this happens the Gangou River rises over a meter from its normal level, running brown with the silt and clay brought down from eroded slopes (ordinarily, even between storms in the summer, the water is crystal-clear), and sometimes flooding nearby fields and pastures. Erosion was compounded by over-grazing – there was less land for grazing and there were larger livestock herds because of the increased human population.

In addition to erosion, this first ecoshock brought about great decreases in biodiversity. The *jjoba* had lost its well-developed forest structure and overstory species diversity as well as the associated forest creatures and understory. Instead of the mix of larger conifer species, oaks, and alders, the overstory of the current forests consists almost entirely of scattered, heavily grazed *Pinus yunnanensis,* a native, early successional species , but whose value for firewood (the largest category of use by residents) is considered to be the lowest of any commonly occurring tree species. Between the fields of buckwheat and grass

and the scattered pine are scrub oaks, rhododendrons, and other plants that grow well in relatively open environments -- the net result is an overall loss in plant and animal biodiversity.

In addition, population growth, from about 250 people in the Yangjuan-Pianshui-Gangou-Zhuchang area in 1957 to about 800 today, has continued to put pressure on the forests. Fuelwood is the only energy source readily available to villagers, and it is questionable whether rates of regrowth of biomass are commensurate with rates of fuelwood combustion and other uses. Our preliminary research indicates that regrowth may just be sufficient, but final determination of sustainability has not been made yet.

Ecoshock #2: a minor one: rice cultivation

In 1963, it was decided by agricultural authorities in Liangshan that high-mountain areas ought to be able to produce rice, at least in lower-lying river valley lands that were readily irrigable. The *ladda* lands around Pianshui and Yangjuan were considered suitable for this purpose, and much of this land was given over to paddy cultivation in 1963-65. Since residents to this day place a high value on rice as a food, it is possible that they went along enthusiastically with this policy, but it was an agricultural and, therefore, an economic disaster, producing only about 250 *jin* per *mu*, about one third of the minimum level usually considered sufficient for rice production in marginal lands.

Ecoshock #3 Taking Grain as the Key Link.

Between 1972 and 1974, according to Mao Zedong's ideas that the country's self-sufficiency and imperviousness to military attack depended greatly on the production of grain, all over Liangshan there was a large-scale program to expand grain cultivation, particularly by terracing mountain slopes or, where terracing was infeasible, clearing and planting directly on the sloping lands. The Baiwu area did not escape this policy, and at this time many areas fundamentally unsuited for grain cultivation were made into little mini-Dazhais. Much of the flood plain of the Gangou River between Gangou and Yangjuan/Pianshui, an area with good summer pastures known as Apiladda, was turned over to grain cultivation, despite frequent losses in major storms. In addition, the lower mountain slopes on both sides of this plain were terraced and grain agriculture was attempted there. This policy resulted in a lot of wasted effort, a diminution of much-needed pasture land, and increased erosion from the terraces and slope fields planted on the mountainsides.

Aside from the indirect loss of forests due to expansion of grain acreage, there was also a direct loss of forests at this time, due to the second of the "three great cuttings" (*san da kanfa*) of southwestern forests. Those areas of the mountains to the east and west of the flood plain of Apiladda, and some areas of the forests between Pianshui and Baiwu, all of which had been spared the logging of the first great cutting in the late 1950s, were logged clean at this time by state logging companies who used the wood for construction. This was basically the end of the original, diverse overstory forests within 5 kilometers or so of the inhabited areas in the Upper Baiwu watershed.

Ecological (or economic) shock #4: Apples as a Commercial Crop

Beginning in the late years of the period of collective agriculture, in the late 1970s, Yanyuan was selected as a key apple-growing area of Liangshan; it was judged that the climate and soils of this mountain county were ideal for this particular crop. The first orchards in Yangjuan and Pianshui were planted by production teams in 1977. By the middle-to-late 1980s, after land had been redistributed to households according to the household responsibility system, families were encouraged to plant apples, and by 1993, much of the area around Baiwu was given over to orchards, walled off against animal intrusions by mud barriers, and filled with neatly planted small apple trees. In a survey in 1993, about half the families in Yangjuan and two other villages near Baiwu had active apple orchards, and in fact starting about 1992, apple production reached commercial levels and became an economic boon to farmers for a few years. At this time, the prices of apples were as much as 0.6 or 0.7 yuan per *jin*, and middlemen in trucks came at every harvest season to select and buy apples directly from the farmers. This adoption of apple culture appeared to be a potentially promising way out of poverty for the people in the Baiwu Valley and other parts of Yanyuan.

But, as Joanne Ho has documented carefully in her thesis, *Pockets of Poverty*, the boon of apples was to be a short-lived one in Yangjuan, Pianshui, and Mianba. As China moved from a general agricultural regime of local self-sufficiency in grain to a regime of local specialization, market exchange, and comparative advantage, it turned out that Baiwu farmers were at a comparative disadvantage, particularly as more and more apple orchards were planted locally and nationally, and China came to produce a majority of the world's apples (53% in 2001). First, the road network leading to the Baiwu area is terrible, and middlemen, who a few years earlier could make a profit off of just about any apples they could acquire, found that the extra transport costs and time it took to get to remote areas like Baiwu, combined with the lower prices they could fetch on the wholesale markets, no longer made the trip worth the transport costs. Second, the quality of apples produced in Baiwu was low compared to those produced in other areas. This was due largely to the local unavailability of the agricultural extension services necessary for farmers to keep up with the varieties, inputs, and methods of cultivation necessary to compete in an ever-choosier urban, middle-class fruit market. Finally, the farmers in the area really had no access to good market information, and could not plan their marketing strategies with any sort of confidence. In 1998 when the middlemen basically quit coming, some farmers hired trucks to transport their crops directly to the urban markets of Xichang or Panzhihua, but the results were mixed: they sold the fruit but made little if any profit. As prices continued to fall, farmers quit taking care of their trees in 1999 and 2000, and in 2001 almost everyone cut down all but a few trees that they let remain so they could pick and eat the fruit or serve it to visiting relatives.

Ecological and economic shock #5: Hybrid corn

At the time people had just about given up on apples as a commercial crop, and begun to cut down their orchards, a new promise appeared on the horizon, in the form of hybrid, high-yielding corn varieties. Developed through

conventional cross-breeding methods (not GMO or genetic engineering) in agricultural research stations in Chengdu, Xichang, and other areas, these varieties were designed to produce high yields in the high-elevation, cool-climate areas of southern Sichuan such as the Baiwu area. A few families in Pianshui had already adopted these varieties and their concomitant methods in the 1990s, but they came in force with a demonstration by an agricultural extension agent at the Yangjuan Primary School in January, 2001, and in the growing season of 2001 most families adopted these varieties.

Nuosu people in Yanyuan, as other areas of Liangshan, have grown corn, which of course is originally a new world crop, for centuries. In Yanyuan, over this long historical period there developed varieties of white-kernel sweet corn, known locally as *lao baogu*, or old corn. These are low-yielding varieties, considered good to eat for humans, usable as animal feed. They require only manure as fertilizer, and have a short enough growing season that they can be planted late in spring after the rains begin, and thus do not need irrigation. Old Corn was probably the third most important crop in terms of acreage, and the third or fourth-most important staple in the local diet, before the advent of apples gave the local farmers some cash income with which to buy rice, and probably gained importance in the diet during the few years after the decline of apple revenues and before the advent of hybrid corn.

The new, hybrid varieties are something else again. Like so many high-yielding, green-revolution type crops, they require much greater inputs to achieve their high-yield potential. Their growing season is long, and they thus need to be planted earlier in spring than the traditional varieties. This means the farmers have to use plastic film mulch (*dimo*) to preserve heat and moisture during the beginning of the crop season, and also that they have to irrigate, a tiring task involving bringing water from the river in buckets and dumping it on plants individually. For this reason, unlike old corn, hybrid corn can only be grown in the *ladda* areas. Mianba, which has no *ladda* land, thus grows no hybrid corn, despite its proximity to Yangjuan and Pianshui. In addition to these additional inputs of money and labor, hybrid corn also requires chemical fertilizers to achieve maximum yields, and in this area farmers usually make two yearly applications of urea and one of phosphate fertilizers, which require additional monetary expense. Finally, the hybrids of course do not reproduce true to variety as does the old corn (some farmers tried it just to make sure they were not being cheated), so farmers have to buy seed corn anew for each growing season.

The benefits from hybrid corn are entirely monetary. Villagers consider the hybrid corn inedible. So they sell about 80% of their harvest to middlemen or to traders in Baiwu town or Yanyuan City, and about 20% they feed to animals; most of this goes to pigs, which in turn can be sold on the market for a profit or consumed locally; a few families also feed this corn to horses. Because of China's recent dietary transition to a diet much heavier in protein than the traditional diets of almost all inhabitants, there is a growth in the animal-feed industry, and this has kept corn prices in Yanyuan high and rising between 2001 and 2004. Most families have made enough money to buy back their inputs of fertilizer, seed, and mulch, and still have enough left over to buy rice, which has begun to replace other grains in their diet, as well as help pay for school tuition if they have children of elementary or secondary school age. As long as the pork

industry keeps growing, Baiwu's corn production is economically just as sustainable as any other crop—but the geographical disadvantage never fades away for Baiwu, and will become particularly salient again if the pork industry declines, or even if feed producers are able to get the same amount and quality of corn from more accessible areas. In the worst case, if growers closer to urban centers also become more efficient than those in the Baiwu area, even if the pork industry is growing or starts to plateau, this too will pull the from rug under Yangjuan and Pianshui's corn-dependent economy.

Hybrid corn has perhaps brought about more changes than any of the previous waves of ecological change that have swept over the Baiwu watershed. It has meant that, for the first time in history, the balance of most villagers' household economies will tip from subsistence to market agriculture. To be sure, there was opium growing in the 1930s and 40s, apples in the 1990s, and all along except in the thick of the most leftist phases of the Cultural Revolution, people have sold pigs or other animals for profit. But now for the first time the cost of inputs is so high that cash income has become necessary to carry on basic agricultural activities, and purchased rice has come to constitute a significant portion of the local diet. Income from corn sales has also made possible for the first time the purchase of such household goods as televisions and bicycles, as well as minor items, and also enabled many children to get more education than their parents had previously been able to afford.

At the same time, other changes have been less favorable. Farmers state that either the urea fertilizer or the plastic mulch (there is a debate as to which) causes the soil in which the hybrid corn has been grown to harden and become impervious to the plow over the course of three or four years, so they have been forced into thinking of a new system of crop rotation, as well as realizing that the cash income from hybrid corn is itself not sustainable. To an as yet undetermined extent, fertilizer residues of nitrates and phosphates are remaining in the soil and being leached into the local water supply; this may cause a change in aquatic biota that remains to be measured. The mulch itself does not degrade rapidly, and despite the farmers' yearly efforts to gather up as much of the used film and burn it after harvest, it hangs around on the thorn branches in an unsightly way for years on end in what people call "white pollution."

Dietary changes are also significant. We have found that rice now has replaced buckwheat as the second most-consumed staple crop (after potatoes) in Yangjuan, Piangshui, and Zhuchang, and lags behind buckwheat and corn only in remote Gangou, which is an extra hour from market for either producers or middlemen, though people are now growing hybrid corn even there.

Ecoshock #6?? Sheep for profit

After the Yangjuan Primary School was constructed with aid from outsiders in 2000, those connected with the school have been seeking ways to increase local sources of income and make the school less dependent on contributions from people outside the community. One idea to promote school income was to begin raising sheep on fodder. Currently, the climate regime of the Baiwu area consists of cold, dry winters, and warm, wet summers, with a mild, dry season in the fall. This means that there is considerable pasture for the sheep, cattle, goats, pigs, and horses in the early summer, when the grasses in the plains area of Apiladda

and on some uncultivated parts of the *jjoba* are flourishing; after those grasses have been grazed over, autumn harvest brings the opportunity to graze on the stubble and fallow fields in the cultivated portions of the *jjoba,* but rains stop and pastures quit growing and dry up in the wintertime, which means that even if they slaughter a larger number of animals for weddings, *kurshyr* (new year) and such seasonal rituals as *xiobu* performed in the Spring, the availability of winter pasture severely limits the number of animals that can be raised. Hence the idea of turning over some previous grain land to fodder crops to feed to penned animals in the winter and spring lean seasons, and letting the animals out to pasture again during the relatively abundant times of summer and fall.

Accordingly, 60 sheep were purchased through a gift from the Taipei Rotary Club in 2004, and two experienced and respected elders were selected to keep thirty sheep each. The sheep belong to the School, but the lambs produced go 80% to the herder and 20% to the school. Through this method, especially if the number of penned sheep and the acreage devoted to fodder crops can be increased, to provide a steady if modest increment of income to the Primary School.

This is another ecological wave coming over the community. It remains to be determined whether this will be a swamping tsunami or just a gentle swell, and Barbara Grub's research is partly designed to probe the micro-ecological outcomes of this project. Will the pastures, even in the abundant seasons of summer and fall, be able to absorb enough extra sheep to make a difference in the income of the school or the herders? Will they cause extra erosion? Succession of inedible plants when the edible ones have been grazed down to the ground? Will the manure they produce in the pens add significantly to the fertility of the fodder crops that feed them or the grain crops that feed their owners? All these questions remain to be answered, but at least there is one hopeful sign that was not present in any of the earlier waves from the concentration of population to the introduction of hybrid corn: the project is was begun at a small scale, and is being monitored from the start, rather than effecting a large-scale, community-wide ecological transformation whose effects are unknown or deliberately ignored until it is too late.

Ecoshock #7?? Labor out-migration

Until the early 2000s, only a few young men had migrated out of the Baiwu area to work in construction, mining, or other menial jobs (there were also a small number of natives who went on to middle-school or even higher education, and became teachers or cadres). But since 2002 in particular, a wave has flowed out of the community. From 2002 to 2004, probably 20 to 40 young people each from the villages of Yangjuan and Pianshui (we have recorded over 20 names from each place, but are sure to have missed some) have gone to such places as Xichang, Panzhihua, Chengdu, various smaller cities in Yunnan, and in some cases as far as Beijing, Shanghai, Xinjiang, and even Burma to take up jobs ranging from digging in mines to road work to waiting on tables in restaurants. In 2005, it is reported that a labor recruiting company from Shanghai or Shenzhen (local opinions vary) came to the village and recruited an even larger number of people for outside work.

Conditions and success of outside work vary; one young man who built

roads in Burma made no money and had to save what little he had for a long time in order to buy his transportation back; others have managed to bring home modest amounts, never more than a few hundred RMB. Nevertheless, most migrants state that they intend to go again, and would like to go to a different place from where they have been before, just so they can see more of the world.

It is unclear what ecological or other systemic effects the ever-increasing wave of out-migration will have. In 2005, for the first time, women left behind in the village complained of a lack of young men to do the fieldwork; this may change if they return at harvest time, which many migrants have done in the past. But given the increased labor demands of hybrid corn and possibly of other new crops yet to be introduced, it may turn out that the labor resources are inadequate to the agricultural tasks, or that machinery will replace human and animal labor (perhaps bringing with it other environmental problems) or that people will have to make a choice between agricultural and migration income.

Lessons to be learned:

Ecological change is as inevitable as economic or social change; it is a fallacy to suppose that there is some sort of ecological balance or equilibrium that can be maintained in a community over a long period. The ecology of Baiwu has been changing ever since humans first inhabited the area, and has been changing rapidly in a series of unpredictable and almost random directions since the series of revolutionary and post-revolutionary tsunamis narrated in this short paper began in the 1950s. The challenge for those interested in community development, in cultural preservation, and in environmental resilience is not to prevent ecological change, but to plan for it, try to foresee when and how it is going to happen, and most of all to monitor it as it goes along, in order to be able to mitigate its more negative effects.

Most crucial in this process of planning and monitoring is attention to local conditions. Much of the harm caused by these ecoshocks over the years has come from the mistaken application of locally unsuitable methods to the local environment. Rice could not be grown in the Yangjuan/Pianshui *ladda* because it was too cold, whatever the general desirability of growing or eating rice. Terraces did not belong on the lower mountain slopes, despite the general desirability of producing more grain. Apples were not going to be economically profitable in an area where farmers suffered from horrible transport conditions, lack of extension services, and exclusion from market knowledge. Whether the currently fashionable cash crops of *huajiao* (Sichuan peppercorns, *Zanthoxylem)* and walnuts eventually suffer the same fate as apples depends on market conditions, but if farmers have no access to or understanding of market information, they will not be able to either take advantage of opportunities provided or protect themselves against possible catastrophes.

Another crucial point is preventing exploitation of local resources by people and forces outside the system. The forests were cut down--twice--for the benefit of outside communities, the first time so that steel could be manufactured and the second so that urban buildings could be constructed. That the steel production of the Great Leap Forward was a failure is immaterial to this argument. Even if China had surpassed England and caught up with America, the mountains around Baiwu still would have been denuded of their trees and

the land would have been eroded and the streams flooded and mudded during the big storms. When apples and other cash crops have been grown, in the beginning the market may have been good enough to bring benefit both to the farmers and to the middlemen and customers, but when the market fails, the relationship becomes exploitative and the villagers are the first to lose their benefits from the transactions. It is unclear at this point whether the current labor migration wave is producing similar results; if the cheap labor the villagers are providing--partly because of curiosity about the world and partly because of boredom and mild desperation about the situation at home--will bring any benefit to them or to the community, but it certainly benefits the factory and mine owners who employ them at such low wages and under such poor conditions. As long as decisions are being made by powerful interests outside the local system, whether they be the policymakers up to and including Chairman Mao himself during the Great Leap Forward, or whether they be the agricultural extensionists or labor recruitment companies of the early 21st century, the villagers and their environment will be in danger.

A third point is monitoring. At present, we do not know what the long-term effects of chemical fertilizers on local soils will be, or what the addition of 60 penned sheep and their lambs will ultimately do to either pasture or farmland. But at least it is possible to monitor the processes of ecological change, and at least they were designed with the local system and the local conditions in mind.

The Baiwu valley is a beautiful place, and despite the catalogue of human disasters presented here, its environment is in incomparably better shape than that of many areas in Liangshan or other minority regions of China. Areas are eroded, but most mountainsides remain intact. Forests on the lower slopes have turned into single-species forests, but at least the trees are there, and it is even possible that they provide enough wood to sustain use indefinitely, especially if out-migration relieves human population pressure in the area. Some grazing lands seem to be converting to inedible species, but there still seems to be enough pasture for most of the animals now in the area. The surface water is full of coliform bacteria, but the groundwater is clean, and preliminary testing indicates that nitrate and phosphate in the water have not yet reached dangerous levels that would alter the aquatic biota irreversibly.

It would be nice to return to the halcyon days of varied bird songss in the forest around the villages, deer to hunt and leopards to wonder at in the mountains, uneroded hillsides and good-tasting corn. This is obviously impossible, given the transformation so far and given the number of people now living in the valley. But there is much that can be saved in the valley, even in the process of assuring adequate health and economic well-being. The challenge is to devise strategies that are locally designed and suitable, to ensure villagers participate to their own advantage and not as objects of exploitation, and to consistently monitor, adjust, and innovate. If the inhabitants of the Baiwu valley are able to learn from past mistakes, but most importantly if they are not forced into continuing mistakes not of their devising, the Baiwu valley will remain a beautiful place and a good place to live in.