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Smallholders and the 'Household Responsibility System': Adapting to Institutional Change in Chinese Agriculture

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Abstract During the last quarter century, China's agricultural sector has undergone a dramatic transformation from collective to private production under the so-called "Household Responsibility System." This incentive system, designed to increase yields, reallocated communal land to peasant households, creating hundreds of millions of smallholders with relative autonomy over land use decisions and crop selection. Based on recent ethnographic research, this paper discusses the smallholder farming system of a mixed-ethnic community that intensively cultivates small land plots for subsistence and market exchange in China's populous southwestern province of Sichuan. The paper characterizes the smallholder system in terms of biodiversity of plant and animal species, market distribution of crops, multiple cropping systems, and labor and technology inputs. The paper also describes how smallholders adapt their agricultural practices and decisions to changing market conditions and agricultural policies. Significantly, these adaptive strategies focus on shifting to the production of various cash crops, including melons and mangoes. Implications for the long-term viability of China's smallholders, particularly in ecologically and economically marginal areas, are also discussed.

Key words Smallholders · agricultural reform · adaptive strategies · cash crops · China

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Introduction

China supports more than one-fifth of the world's population (approximately 1.3 billion people) with less than 7% of the world's arable land. Its massive population is 68% rural (Chinese Statistical Bureau 2005), and 47% of its labor force is in the agricultural sector. Agriculture in China is dominated by intensive smallholder production, which has sustained a permanent, dense population for many centuries with relatively low land availability (0.39 hectares per agricultural worker) (Gale 2002: 44).

During the Maoist period, agricultural production was controlled by the state via a network of communes, production brigades and production teams overseen by state cadres. The Household Responsibility System introduced in the 1980s brought about yet another radical shift in the organization of Chinese agriculture. Farming households were granted the rights to make their own production decisions and earn residual income from their land by selling crops in burgeoning markets. The Household Responsibility System has reestablished China as the world's largest smallholder farming system. However, amidst a backdrop of rapid economic liberalization that the Chinese refer to as "Reform and Opening" (*gaige kaifang*), smallholders now face a number of difficult challenges, including an increased demand for cash income to pay for services previously provided by the state; a growing emphasis on the production of commodity crops; and a land tenure system that creates uncertainty about future access to farmland. Farmers in less developed regions, where infrastructure is poorly developed and access to markets is limited, must often find their own solutions to their economic problems.

While much has been written about the economic and policy factors driving this transition in China's agricultural

system at the macro-level, its effects on individual farmers and agrarian communities are less well known. The aim of this paper is to highlight the dramatic changes currently in process in China's smallholder agricultural system and to discuss the adaptive strategies that smallholder farmers use in order to maintain economic viability. The paper examines these issues through the use of a case study focused on Futian Township, located in Panzhihua Municipality, in China's mountainous southwestern province of Sichuan. Data are drawn from semistructured interviews and household surveys with 48 smallholder farmers in the township, supported by interviews with township government officials and a review of documents provided by the township office of agricultural technology. Data were gathered during seven months of field research in the study community from 2002 to 2006.

Remaking a Smallholder Farming System

China's land tenure system prior to the socialist revolution of 1949 reflects the deep antagonism that existed in traditional rural Chinese society, which was comprised of four classes. Landlords, who held usufruct rights and imminent rights to large tracts of land, earned profits by renting to peasants. Rich peasants and middle peasants, distinguished largely on the basis of the size of their land leases, cultivated the land and paid rent, sometimes in kind, to landlords. Poor peasants lacked any land of their own and earned a wage by cultivating land held by the higher classes (Fei 1939: 179). As the Chinese Communist Party established a system of governance based on socialist ideals, private farming was prohibited in 1952 and a system of collective agriculture was instituted. This system became the basis for economic and social life in rural China for nearly three decades.

After Deng Xiaoping, architect of China's Reform and Opening policies, ascended to power in 1978, the Party began experimenting with decollectivized agriculture in selected villages in Sichuan and Anhui provinces. These experiments met with initial success, and agricultural collectives throughout China were rapidly dismantled. By the 1980s peasants were subject to the new Household Responsibility System, under which they were granted land leases on five-year terms, extended to 15 years in 1984 and 30 years in 1993. Under the Household Responsibility System, peasants are free to make crop selection decisions and sell crops on the market for profit, after meeting basic grain procurement requirements set by the state (Oi 1999; Selden 1998). This effectively reinstituted China's long-standing tradition of smallholder agriculture.

Futian Township, the site of this study, is located on the western edge of Panzhihua Municipality, in China's mountainous southwestern province of Sichuan (see Fig. 1). The township and surrounding areas were annexed from Yunnan province in 1965 as part of a national campaign to build a state-owned iron and steel smelting plant in Panzhihua. Ranging from 1,022 to 1,640 m above sea level, Futian occupies very mountainous territory. Soils are of good quality, moderately pervious clay, and neutral pH (Hannaway 2005: 191–193), but the local terrain is steep and rocky; a common adage in Sichuan is that a person must "remove a wheelbarrow full of rocks just to grow a mouthful of rice." The climate is mild, with a mean annual temperature of 22°C and a mean precipitation total of 87 cm, most of which falls during the summer monsoon season (June–September).

The average annual household income in Futian was 3,637 Yuan in 2004, slightly above the provincial average and well below the national average.[1] The township thus reflects the pattern of uneven development that is characteristic of contemporary China. This pattern has been aptly characterized as "one country with four worlds": the high-income areas of the eastern coastal region, including Beijing and Shanghai; the middle-income areas such as Tianjin, Guangdong, Zhejiang and Jiangsu, also on the east coast; the low-income, primarily agricultural areas of China's interior; and the remote Western areas with substandard living conditions (Hu 2003).

Uneven economic development stems partly from simple geography. The vast, comparatively arid interior regions of western China, though endowed with abundant mineral resources, are generally less agriculturally productive than the fertile floodplains and river deltas of the eastern regions. Eastern ports, with their bustling commerce and access to global capital and consumer markets, are far away. The economic lag in China's interior is also due to policies implemented at the highest levels of the central government. Deng Xiao Ping's Reform and Opening policies during the 1980s emphasized a coastal development strategy to attract foreign trade and investment, while China's western regions, with limited access to markets and poorly developed transportation infrastructure, fell further behind the fast-paced development of the east (Lai 2002, Li and Chen 2000, Wang and Hu 1999). Furthermore, many western provinces, including Sichuan, have high concentrations of "minority nationalities" (*minzu*). These ethnic minority groups, distinctive from the dominant Han Chinese by varying degrees in terms of language, subsistence patterns and cultural practices, constitute a primary development target for the central government. Futian Township, the site of this study, is a mixed ethnic community of Han and Shuitian, a group officially classified by the government as part of the Yi minority nationality.

[1] The exchange rate is approximately 8.2 Yuan = 1 USD.

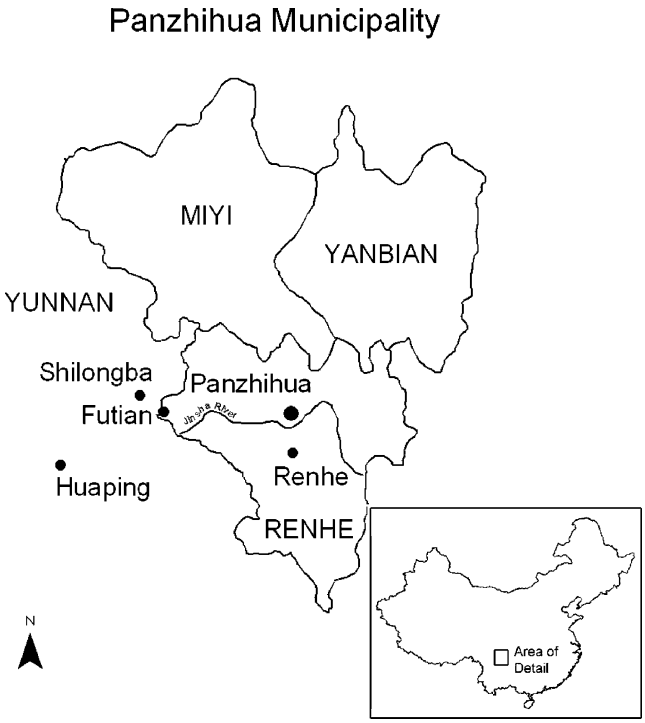

Fig. 1 Map of study area: Futian Township, Panzhihua Municipality, Sichuan

In China, the rural land rights regime exhibits considerable variability in different regions (Rozelle *et al*. 2005; Kung 1994, 1995) but is commonly seen to contain four fundamental dimensions: the right to residual income generated from agricultural activity on land; the right to use land in relative freedom from state regulation and other encumbrances; security of tenure rights into the future; and land transfer rights (Liu *et al*. 1998). The land rights regime in Futian receives a mixed score on these four dimensions. At present, farming households in Futian lease parcels of irrigated paddy field for growing rice and dry agricultural fields for other crops. Increasing liberalization of agricultural markets gives local farmers access to residual income, after filling state-set grain quotas. Decisions regarding crop selection, cultivation, and market distribution are all made at the household level, and economic risk within China's rapidly changing market economy is also assumed at the household level.

Security of future tenure rights is a major issue in Futian and elsewhere in rural China. In contrast to urban land, which is owned by the central government (*quanmin suoyou zhi*), rural land rights are vested in rural collectives (*jiti suoyou zhi*) at the level of township, village, or production cooperative. Individual smallholders in Futian are granted certificates that give them use rights but not full ownership rights over two types of land leased from the rural collective: "responsibility land" (*zeren tian*) and "contract land" (*chengbao tian*). Responsibility land is allocated to households in exchange for delivery of a grain quota to the state, while contract land is leased to households who wish to expand their landholdings, often through a bidding process (Swinnen and Rozelle 2006: 57; Rozelle *et al*. 2005; Oi and Walder 1999). The collective maintains the right to appropriate land within its jurisdiction when necessary. Agricultural land may not be bought or sold by individuals, and those who have invested in infrastructural improvements such as irrigation have no guarantee that they will ultimately benefit from such investments. The current smallholder system is thus the product of a combination of factors, including ecological and topographical conditions that make large-scale, mechanized agriculture difficult, central policy favoring collective land ownership, and a complex leasing system that makes consolidation practically impossible.

Characterizing the Local Smallholder System

Land Use Patterns

Land use in Futian Township is based on five broad categories of land. Commercial and industrial land, which is owned by the township government and leased to private citizens, is located in a specially zoned area called an "open district" along the main road that runs through the north edge of the township. Residential land parcels are also under the ownership of the township government, which allocates use rights to individual households for housing construction. The remaining three land use categories pertain directly to agriculture: irrigated paddy fields (*tian*); dry agricultural fields (*di*); and steeply graded lands used for animal forage or reforestation and referred to colloquially as "waste land" (*huangshan*).

Table I provides a characterization of the three agricultural land types in the township. The township encompasses 83,242 *mu* (5,494 hectares) of land, most of which is either too steeply graded or too poor in soil quality to support agriculture.[2] Residential and agricultural density is greatest at lower elevations along a small tributary stream to the Jinsha River, the major headwater of the Yangtze. Agrarian reform in the township was undertaken in 1982 under the direction of 21 small production cooperatives (*xiao zu*) within the township, which had the task of allocating specific parcels of irrigated paddy and dry fields to peasant households. This was done based on household physiology: households with more members were given more *mu* of land. Because land within each production cooperative typically varied in terms of soil type, water access, and other factors, land allocation decisions were highly politicized. In cases where multiple households claimed the same

[2] The *mu* is the standard unit in China for measuring land area and is equal to 0.066 hectares or 0.165 acres.

Table I Characterization of Agricultural Land Types in the Study Community

Land type	Land area (mu)	Average household land holding (mu)	Land tenure structure
Irrigated paddy (*Tian*)	2,010	1.8	Transfer rights held by rural collective; use rights leased to households; may include "responsibility land" and "contract land"
Dry agricultural fields (*Gan Di*)	1,380	1.3	Transfer rights held by rural collective; use rights leased to households; may include "responsibility land" and "contract land"
Mountain slopes (*Huangshan*)	65,000	N/A	Transfer rights held by township government; access to grazing controlled by township government

land parcel, lots were drawn. Because nearly all land in the township is mountainous, paddy fields are maintained through an intricate terracing system. Terraces are supported by walls of packed earth, and terrace edges are often sown with trees or crops, such as sweet potatoes, broad beans, and peas, both to increase productivity and to prevent erosion. Dry agricultural fields are typically located up the valley away from the local stream. Households use these fields to cultivate vegetable and fruit crops for subsistence and market distribution. Because they lack an irrigation source, dry fields must be intensively irrigated by farmers, a process that entails carrying water by hand from the valley stream or irrigation canals.

Land parcelization is a problem for many farmers; a single household may hold several *mu* of paddy and several *mu* of dry fields located hundreds of meters away. Unproductive mountain slope land comprises the majority of lands in the township and is owned by the township government. These high-elevation lands, covered by grass and chaparral, are arid, steeply graded, and unsuitable for agriculture. A number of households specialize in goat herding and use these lands year-round as forage for their herds.

Biodiversity

The smallholder farming system in the study community supports a wide array of plants and animals. Table II shows the nearly 60 plant and animals species that contribute to the agricultural economy in Futian Township, along with a description of their cropping seasons and common uses. Table II also illustrates the distribution patterns of each species within the agricultural economy at the household, local (i.e., township market), and regional (i.e., within Panzhihua municipality) levels. Rice (*Oryza sativa japonensis*), which is grown on irrigated paddy land, is the most widely cultivated grain crop in the township. China produces both *indica* and *japonica* varieties of rice. Indica is grown mostly south of the Yangtze River, although most Chinese consumers don't prefer it because of its small grains and mushy texture when cooked. The growth period for rice is approximately 180 days. Nearly every agricultural household participates in the cultivation of *japonica* rice; the only exceptions are those few households who receive state grain subsidies in exchange for their participation in the national reforestation campaign. Winter wheat is sometimes sown on paddy lands in a sequential cropping pattern and harvested prior to the summer rice season; the practice is not widespread in Futian, however, due to low wheat prices in recent years. Corn, which is grown as a dry land crop and must be intensively irrigated, is used both as a human food source and as animal fodder. Poor households also use corn stalks as a fuel source for heating and cooking.

A total of 29 plant and root crops are commonly cultivated in the study community. The vast majority of these species are grown as food for household consumption and local market distribution. Farmers are beginning to cultivate several species of melon (cantaloupe, honeydew, and watermelon) on a large scale for market distribution in Panzhihua City as part of a new township development strategy, as will be discussed in the next section. In addition, sweet potatoes and yams are cultivated as fodder for animals. Because of the township's latitude (approximately 27° N) and its mild climate, many species can be double-cropped or cultivated year-round.

In addition, 16 tree and shrub species are integral parts of the agroecosystem in Futian. For the past 15 years the township has implemented a national reforestation campaign aimed at reversing some of the ecologically destructive policies of the socialist economy. During the Great Leap Forward (1958–1961), when rural areas were encouraged to promote small-scale industrial development, many forest tracts were felled. The Yangtze River watershed, including the upper reaches where Futian is located, was heavily deforested and several catastrophic floods resulted. Eucalyptus (*Eucalyptus camaldulensis*) and Yunnan Pine (*Pinus yunnanensis*), which both grow well under a variety of ecological and soil conditions, are the species of choice for the reforestation campaign and are commonly planted on mountain slope land managed by the township government. Both of these tree species also serve as an occasional fuelwood source for villagers, although harvesting from reforested lands is strictly forbidden by policy. A small

silkworm-producing cooperative has operated in Tangba village in the southwestern part of the township since 1988 and provides cocoons to a silk company in Panzhihua. White mulberry trees, whose leaves provide the sole food source for the growing larvae, are widely cultivated by households whose land is in close proximity to the silkworm cooperative. Mulberry was traditionally planted on field edges, but is now grown in greater abundance, and in some cases as a monocrop. A variety of fruit trees, generally intercropped with other plant species, are also grown.

Every household keeps a number of hauling and draft animals, including donkeys, mules, and water buffalo. During the winter months when rice paddies are fallow, water buffalo are allowed to forage in the paddies and their dung is a highly valued organic fertilizer. Chickens, ducks and pigs are also universally kept for food and eggs. Chickens and ducks also play an important role in pest control. Pork is the primary protein source for local villagers. Goat herding is a specialized activity undertaken by a small number of households, who graze the animals on steep mountain lands (*huangshan*) and sell them for butchering in the Panzhihua market. A number of households specialize in carp production. The fish are raised in artificial ponds and sold regionally; nutrient wastes from fish ponds are commonly used as fertilizer for both paddy fields and dry fields.

Multiple Cropping Systems and Agricultural Inputs

China maintains a high level of food production through intensive cultivation and multiple cropping systems, particularly in the southern and southwestern regions (Cheng 2001). Multiple cropping systems in China can be viewed as an adaptation to economic instability when farmers are uncertain about the market conditions for their crops (Veeck and Li 1996: 58). All households in Futian use some variety of a multiple cropping system on their dry fields. Most crops on dry fields are planted as either intercrop (multiple crops planted in rows together) or relay-planted systems (multiple crops planted in chronological succession). Intercropping takes advantage of complementarities between crop species in terms of plant structure, nutrient requirements, and growing season. One of the most interesting intercropping systems common in the township is the relationship between corn and several legume species, including broad beans and peas. Broad beans are often planted in close proximity with corn. Peas are planted in autumn; by the time the vines are maturing, the corn (along with tall wooden stakes driven into the ground) provides a climbing structure for the pea vines. In turn, the peas provide excellent nitrogen fixation for the soil, reducing the demand for nitrogenous fertilizers. Corn and spring sweet potatoes are also planted in an intercropped system.

Labor expenditure in the township varies considerably by season. The busiest time of year is between the spring and autumn equinoxes (*chunfen* and *qiufen*, roughly March through September), as demarcated by the Chinese traditional agricultural calendar (*nongli*). Tasks involved in maintaining rice include turning over the soil, leveling and flooding the paddy, cultivating juvenile rice shoots in the germination nursery, transplanting shoots into the fields, weeding, monitoring irrigation, and harvesting and threshing the rice. Tasks involved in maintaining dry land crops vary depending on the species composition of the field but generally include planting, irrigation (often by hand), weeding, applying fertilizer, and harvesting. Chemical inputs, including fertilizers and pesticides, have been used in Futian only since the 1980s, significantly later than many coastal areas, which began adopting Green Revolution technologies in the 1960s.

Mechanization in the smallholder system is minimal. China's use of tractors per 1,000 hectares is only one-third of the world average (Gale 2002: 8); mechanization is particularly impractical in this area of Sichuan, where population pressure is high and land plots are small, steeply graded and terraced. Several two-wheeled walking tractors constitute the only mechanized agricultural inputs in the township. The smallholder system is supported by a series of dikes and canals that has existed longer than any current villager can remember. A number of natural springs feed into the water system; in addition, a small dam on the local tributary to the Jinsha River, constructed in 1975, provides a year-round reservoir which can be used for irrigation and watering livestock. Major portions of the canal system were improved with cement in the 1990s, and each production cooperative allocates a share of labor to maintaining the canal system on an annual basis.

Smallholders in Transition: Adapting to Institutional Change

Smallholders in Futian are increasingly integrated into the regional agricultural market as transportation infrastructure improves. Since the completion of a highway reconstruction project several years ago, farmers can make the 50-km trip to the municipal center of Panzhihua in under one hour, a trip which previously took several hours. With increased access to an urban market and central policies that afford them relative autonomy over production decisions, smallholders in Futian are making radical changes in their crop selection and cultivation strategies. Table III provides an overview of major agricultural activity in the township in recent years. Grain production (primarily *japonica* rice) has remained stable. Silkworm production and aquaculture output have risen steadily as township households continue to build economic ties with

Table II Diversity, Distribution and Uses of Species in the Smallholder Agro-ecosystem

Common Name	Scientific Name	Chinese Name	Cropping Seasons	Distribution	Uses
Grain Crops					
Corn	*Zea mays* L.	yumi, baogu (玉米, 包谷)	Dec-July	H, L	* □ ●
Rice	*Oryza sativa* L. (var. *japonensis*)	dami, dagu (大米, 大谷)	Mar-Sep	H, L, R	*
Wheat	*Triticum aestivum* L.	Xiaomai (小麦)	Oct-Feb	R	*
Plant and root crops					
Aloe	*Aloe vera* L.	luhui (芦荟)	Year-round	H, L	+ ◆
Bitter Gourd	*Momordica charantia* L.	kugua (苦瓜)	Nov-Jan	H, L	*
Bok Choy	*Brassica rapa* L. (var. *chinensis*)	baicai (白菜)	Feb-Apr, Oct-Dec	H, L	*
Broad Bean	*Vicia faba* L.	candou (蚕豆)	Nov-Apr	H, L	*
Cantaloupe	*Cucumis melo* L. (var. *cantalupensis*)	xianggua (香瓜)	Nov-Mar	H, L, R	*
Chili Pepper	*Capsicum chinense* Jacq.	lajiao (辣椒)	May-Aug	H, L	*
Chinese Chives	*Allium tuberosum* Rottl. ex Spreng.	jiucai (韭菜)	Nov-Apr	H, L	*
Chinese Kale	*Brassica oleracea* L.	gailan (芥兰)	Feb-Apr, Oct-Dec	H, L	*
Cucumber	*Cucumis sativis* L.	huanggua (黄瓜)	Mar-May, Jun-Aug	H, L	*
Dwarf Banana	*Musa acuminata* Colla.	xiangjiao (香蕉)	Jan-May	H, L	*
Eggplant	*Solanum melongena* L.	jiazi (茄子)	Apr-Jul	H, L	*
Garlic	*Allium sativum* L.	dasuan (大蒜)	Oct-May	H, L	*
Green Pepper	*Capsicum annun* L.	lu lajiao (绿辣椒)	May-Aug	H, L	*
Honeydew Melon	*Cucumis melo* L. (var. *inodorus*)	tiangua (甜瓜)	Nov-Mar	H, L, R	*
Leek	*Allium ampeloprasum* L. (v. *porrum*)	jiucong (韭葱)	Nov-Mar	H, L	*
Mung Bean	*Vigna radiata* (L.) R. Wilczek	ludou (绿豆)	Mar-Jul	H, L	*
Mustard	*Brassica juncea* (L.) Czern.	jiecai (芥菜)	Mar-May, Sep-Nov	H, L	*
Napa Cabbage	*Brassica rapa* L.	dabaicai (大白菜)	Year-round	H, L	*
Onion	*Allium cepa* L.	yangcong (洋葱)	Oct-May	H, L	*
Pea	*Pisum sativum* L.	wandou (豌豆)	Oct-Feb, Mar-Jul	H, L	*
Peanut	*Arachis hypogaea* L.	huasheng (花生)	Dec-Apr	H, L	*
Potato	*Solanum tuberosum* L.	tudou (土豆)	Dec-May	H, L	*
Sugarcane	*Saccharum spp.* L.	ganzhe (甘蔗)	Year-round	H, L, R	*
Sweet Potato	*Ipomoea batatas* L.	baishu (白薯)	Year-round	H, L	* □
Tobacco	*Nicotiana tabacum* L.	yanye (烟叶)	Oct-Apr	R	∇
Tomato	*Solanum lycopersicum* L.	xihongshi (西红柿)	Feb-Jul	H, L	*
Watermelon	*Citrullus lanatus* (Thunb.) Matsum.	xigua (西瓜)	Nov-Apr	H, L, R	*
Yam	*Dioscorea japonica* Thunb.	hongshu (红薯)	Oct-July	H, L	* □
Zucchini Squash	*Cucurbita pepo* L.	nangua (南瓜)	Jan-Jul	H, L	*

Trees and Shrubs

Bamboo	*Phyllostachys spp.* Siebold, Zuccarini	zhuzi (竹子)	Year-round	H, L	• ♦
Blood Orange	*Citrus sinensis* (L.) Osbeck	xuecheng (血橙)	Mar-Jul	H, L, R	*
Eucalyptus	*Eucalyptus camaldulensis* Dehnh.	anshu (桉树)	Year-round	H, L	• ∇ ⊕
Hemp	*Cannabis sativa* L.	dama (大麻)	Year-round	R	∇
Hibiscus	*Hibiscus rosa-sinensis* L.	furong (芙蓉)	March-April	H	♦
Kapok	*Ceiba pentandra* (L.) Gaertn.	panzhihua (攀枝花)	Feb-Mar	H, L	* ♦
Mandarin Orange	*Citrus reticulate* Blanco.	ganzi (柑子)	Mar-Jul	H, L, R	*
Mango	*Mangifera indica* L.	mangguo (芒果)	Jan-Jun	H, L, R	*
Papaya	*Carica papaya* L.	mugua (木瓜)	Oct-Jun	H, L, R	*
Peach	*Prunus persica* (L.) Batsch.	taozi (桃子)	Mar-Sep	H, L, R	*
Pomegranate	*Punica granatum* L.	shiliu (石榴)	Mar-Sep	H, L, R	*
Rhododendron	*Rhododendron spp.* L.	dujuanhua (杜鹃花)	Feb-Mar	H	♦
Rose	*Rosa spp.* L.	meigui (玫瑰)	May-Aug	H	♦
Rubber Tree	*Hevea brasiliensis* Müll.Arg.	xiangjiaoshu (橡胶树)	Year-round	R	∇
White Mulberry	*Morus alba* L.	sangshu (桑树)	Year-round	L	∇ □
Yunnan Pine	*Pinus yunnanensis* Franchet	yunnan songshu (云南松树)	Year-round	H, L	• ∇ ⊕

Animal Species

Chicken	*Gallus gallus domesticus*	ji (鸡)			*
Donkey	*Equus asinus* L.	luzi (驴子)			∇
Duck	*Anas platyrhynchos*	yazi (鸭子)			*
Goat	*Capra aegagrus hicus* L.	yang (羊)			*
Horse	*Equus caballus* L.	ma (马)			∇
Mule	Hybrid (*Equus caballus* x *E. asinus*)	luozi (骡子)			∇
Pig	*Sus spp.*L.	zhu (猪)			*
Rabbit	*Oryctolagus cuniculus* L.	tu (兔)			*
Silkworm	*Bombyx mori* L.	canchong (蚕虫)			∇
Silver Carp	*Hypophthalmichthys molitrix* Valenc.	liyu (鲤鱼)			*
Water Buffalo	*Bubalus bubalis* L.	shuiniu (水牛)			∇ ⊕

Distribution: H=Household, L=Local, R=Regional

Uses:

* Food
+ Medicine
• Fuelwood, timber and construction
∇ Economic uses
□ Animal fodder
⊕ Ecological services
♦ Ornamental

Table III Agricultural Output in the Study Community by Major Category, 2001–2005

Category	2001	2002	2003	2004	2005
Grain output (tons)	2,638	2,608	2,503	2,573	2,711
Fruit output (tons)	158	197	214	1,618	2,156
Aquaculture output (tons)	12	10	11	16	20
Silkworm Production (tons)	10	12.5	15.4	19	21
Meat production (tons)	447	454	460	498	491

Panzhihua City. The most dramatic findings illustrated by Table III, however, relate to selected fruits grown as commodity crops; output has increased more than tenfold in the past five years. This is in line with the national trend: since shortly after Reform and Opening, China's total cultivated area of grain crops has continued to fall, while the cultivated area for commodity crops such as vegetables and fruits has risen steadily (Chinese Ministry of Agriculture 2005: 98–99).

Specialized fruit production began in Futian in 1996 with the introduction of an experimental program operated by the Panzhihua Agricultural Science Center. The focus is on watermelon, honeydew melon, cantaloupe and mangos. Melons, which require little capital investment, have become a particularly lucrative commodity crop. A recent economic strategy document published by the township government suggests that farmers can plant one *mu* of honeydew melon with a total investment of 700 Yuan, yielding an expected 1.5 t of melon at a market value of 2,500 Yuan. After subtracting expenses, the 1,800 Yuan profit constitutes a major portion of annual household income. Approximately 400 *mu* of cropland is presently sown in honeydew melon; township officials expect this figure to reach 1,500 *mu* by 2010.

For the first time ever, there are now a number of households in Futian whose economic viability is based solely on the market. These households participate in the government-sponsored reforestation campaigns, planting no rice and relying on state grain subsidies. In turn, they plant their dry fields entirely with commodity crops for sale in the regional market, using cash profits to purchase food for household consumption. Most households use a combination of chemical fertilizers, which they purchase with cash, and organic fertilizers from human and animals wastes and fish pond nutrients. Chemical inputs vary depending on ecological conditions, but the use of nitrogenous fertilizers has risen steadily since their introduction in the 1980s. This provides a means for smallholders to increase farm productivity (yield per unit land), while efficiency (yield per unit labor) remains relatively unimportant due to an abundance of rural labor (Dong 1991: 71).

In studies of agricultural intensification, population growth and density are usually viewed as key driving factors. Innovations in labor, technology, and cultivation strategies can thus be seen as a means through which a growing human population can stretch the constraints placed upon it by a finite natural environment (Cleveland 1998; Netting 1993; Boserup 1965). While this paradigm may have been useful in understanding agrarian change in historical China, it has limited explanatory value in reform-era China's agricultural system, which is continually reshaped by political and institutional changes in agricultural governance within the central government. Changing cultivation strategies in this case represent an adaptive mechanism for dealing with several changes brought on by liberal economic reforms in contemporary China, including the demand for a cash income, the commercialization and mechanization of food production and consumption, and the decline in the rural industrial sector.

Viewed in the light of China's Reform and Opening policies, the shift to commodity crops is a rational response to the profit motive created by market liberalization: grain prices remain under the control of the central government, but non-grain commodity crops prove a lucrative option for farmers who can gauge market demand and adjust their cultivation practices accordingly. Household incomes in Futian have risen modestly in recent years. Most farmers welcome any increase in cash income, since the central and provincial governments continue to implement Reform and Opening policies by pulling back from the provision of key services such as education and health care. The continuing liberalization of China's agroeconomy means that farmers must participate in the market in order to provide a decent standard of living for their families. Investment in children's education is generally the largest cash expenditure for local households. The township has four primary schools, but families who wish to provide a middle-school and high-school education for their children must send them to the district town of Renhe, where they pay room and board as well as tuition. This provides a powerful incentive for smallholders to increase their cash income by growing commodity crops.

As households have greater access to discretionary income from increased yields, off-farm labor and remittances, they are purchasing a greater share of their diet. The commercialization of food consumption encourages smallholders to specialize in particular commodities and forge new links with processing and distribution networks (Gale 2002: 16; Huang and Rozelle 1998). Futian's fruit crops find markets not only in the nearby city of Panzhihua but also in neighboring townships in the surrounding rural areas.

Futian's participation in the burgeoning market for commodity crops is also due in part to recent changes in the structure of the local industrial sector. Like many rural communities, Futian invested heavily in small-scale factories called "township and village enterprises" during the 1980s and 1990s as part of a national development strategy

that aimed to increase industrial output in rural areas by encouraging farmers to "leave the land but not the countryside" (Guldin and Goldschmidt 1997). In Futian, township enterprises included a number of zinc smelting plants, a coking plant, and a coal-washing plant. Industrial profits and taxes served as a major revenue source for the township government, which used the revenues for community development projects including road construction and school improvements. However, local factories were closed in 2003 by officials from the district Environmental Protection Bureau for on-going violations of national air and water quality standards. Since the factory closures, industrial revenues have completely disappeared and the township government is carrying 17 million Yuan in debt (Tilt 2007). In the absence of other development strategies, local cadres and agricultural specialists are encouraging the township's smallholders to increase commodity crop production, as a way to both increase household incomes and broaden the township's tax base. Agricultural households were previously taxed based on the amount of land under cultivation each season; in recent years, however, farmers report being taxed on their total land holdings, including fields left fallow, as the township government seeks new revenue sources.

Ironically, despite rapid liberalization of the agricultural sector, some elements of the local agroeconomy remain unchanged. The seasonal demand for labor during rice planting and harvesting means that smallholders often pool their labor in ways that mirror the collective work teams of the socialist period. Furthermore, Futian's 21 production cooperatives, which are vestiges of the socialist economy, are beginning to coordinate production activities and establish distribution networks for the township's commodity crops. They have purchased several trucks for hauling crops to Panzhihua and to surrounding townships. These socialist institutions have not disappeared; rather, they provide a support network for smallholders eager to participate in a market-oriented agroeconomy.

Conclusions

Through the use of a case study of a rural township in Sichuan province, this paper has highlighted the major changes in agricultural governance in China, as well as the strategies smallholders use to cope with these changes and maintain their economic viability. The smallholder system in the study community supports a wide array of plants and animals that circulate in the agroeconomy at the household, local, and regional scales. Multiple cropping systems combined with high labor inputs have served to provide farmers with sufficient output of grain and other crops. Much of the scholarship on smallholder farming systems views ecology and demography as the key variables driving innovation in agricultural practices (Cleveland 1998; Netting 1993; Boserup 1965). This case suggests, however, that changes in agricultural governance must also be taken into consideration. Economic liberalization under China's Household Responsibility System has given farmers autonomy over crop selection decisions and provided them with a powerful economic incentive to cultivate commodity crops for the growing consumer market. Farmers in the study community have responded by investing their labor and capital in the production of melons, mangoes and other commodity crops, often to the exclusion of subsistence crops.

This shift has the potential to increase household incomes, a welcome development in regions that have long suffered from cultural and economic marginality. It also creates considerable risk for individual smallholder families, who must meet their own economic needs as the state provides less security and fewer services than during the socialist period. In fact, many challenges threaten the long-term viability of the smallholder system. Rural–urban income disparity continues to grow and is one of China's most pressing social problems (Riskin *et al*. 2001). Regional economic disparities are also deepening as China's coastal areas participate in the industrial, commercial and service sectors of the global economy. This highlights the relative depravation of western and southwestern China, which have high concentrations of ethnic minorities and lack the favorable infrastructure and markets of the east (Lai 2002; Li and Chen 2000, Wang and Hu 1999).

Property rights in rural China are highly ambiguous, and farmers are often uncertain about the specific rights they have in relation to agricultural land. This ambiguity has been aptly described as "institutional indeterminacy" (Ho 2001), which allows China's land tenure system to function at the current stage of economic reform, which is somewhere between state-controlled and market-oriented. Evidence suggests that, amidst a widening income gap between the agricultural sector and other sectors of the Chinese economy, many smallholders would prefer to leave farming entirely (Kung 1995). But insecurity in the rural land tenure system creates conflicting motivations for farmers, many of whom remain in the agricultural sector for fear of losing their land rights.

Outright privatization of rural land might seem the logical next step in China's Reform and Opening policies, which have already wrought dramatic changes in agricultural governance over the past 25 years. But the central government shows no signs of lessening its commitment to collective land ownership and long-term land leases under the Household Responsibility System. Privatization would likely lead to consolidation of land holdings. Land consolidation, which would increase the ratio of land per agricultural worker, would likely improve efficiency, but

remains impossible since households do not possess transfer rights over their land. An average household in Futian cultivates only three *mu* (0.2 hectares) of land; as a result, there is little chance for smallholders to participate in an economy of scale. Land tenure thus remains a balancing act between market liberalization, which demands greater efficiency through consolidation, and the centrifugal force of state policies, which maintain the current system of smallholder parcelization.

As smallholders in the study community are increasingly integrated into market-driven agriculture, grain security remains a primary concern for the government. Although rice yields showed impressive growth in the early reform years at the national level, China's appetite for grain is so high that relying on grain imports may be necessary in the near future. Some scholars have argued that the land tenure regime in the countryside is again the culprit and that grain production in recent years has remained flat because farmers lack secure rights over the land they cultivate and therefore lack a long-term profit motive (Prosterman *et al*. 1996). Smallholders in Futian, driven by rising prices for commodity crops, have little incentive to grow grain beyond the state-mandated quota.

Additionally, the globalization of agricultural production and consumption is beginning to exert considerable pressure on China's smallholder farming system. China's accession to the WTO in 2001 has reduced tariffs on most agricultural products and loosened state control over tariffs and quotas of imported agricultural goods (Chinese Ministry of Agriculture 2005: 35). This is beginning to affect the production of major commodity crops, such as sugarcane, as China's domestic market is flooded with imports from other countries (Li and Tilt 2007).

The long-term effects of this trend toward commercialization of crop production are still uncertain. From an ecological perspective, evidence suggests that intensive, commercial agriculture requires monocropping, increased chemical fertilizer application, and shortened fallow periods. The result is often a decline in biodiversity and a subsequent threat to sustainability of the agroecosystem (Chapin *et al*. 1997; Matson *et al*. 1997). China's land tenure system exacerbates this problem, since farmers benefit from increased yields in the short-term but have no guarantee of long-term tenure. Recent political-ecological case studies in the Caribbean (Grossman 1998) and West Africa (Bassett 2001) suggest that commodity agriculture can result in stable economic and ecological conditions. In these cases, success hinged on forming new and supportive relationships between local communities and the central government on issues of crop pricing and distribution. As China's agricultural policies and markets continue to evolve, smallholders face a dizzying array of decisions about how to manage their land for economic and ecological sustainability.

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