

# Valuing Rural Lands from the Ground Up: A Case Study in Establishing a Rural Land Registration and Cadastre System in Anhui Province, China

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*Rural land registration and mapping pilot projects are intended to increase food security in China and increase land tenure security for rural farmers. (all photos by Christopher Barlow)*

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It was mid-September 2010 and the rice fields of Yangwan village were tall and dark green and nearing harvest time. Thunderstorms were blasting the countryside, putting a real damper on efforts to map rural parcels and collect farmers' household information. I stood outside of a small collective village meeting hall where nearly ten months earlier in the cool brown days of November, International Land Systems (ILS), Inc., in collaboration with the provincial Anhui Agriculture Commission (AAC), had kicked off a pilot project to develop a new rural land registration and cadastre mapping project.

Much progress had been made since that time, but on this particular September day, with rain from a typhoon lashing the countryside for five straight days, field work faced a significant rain delay. In the 100-square-foot Yangwan village meeting hall, farmers crowded around a small table. On a village parcel map created by the project team, they were identifying their homes and also their agriculture parcels.

The rain hadn't dampened their excitement, however. This was the first time they had seen a satellite-based view of their village. It was a unique perspective of their commu-

nity—of their world. And they were eager to point out the lands they had contract rights to, so these land parcels could be registered, certified by the county government, and then stored digitally in ILS LRS, a land registration system. This was the first time this per-household level of property had



*Project team members document existing rural land certificates and match them to the village parcel map.*



been delineated and detailed in this village and, for that matter, probably in any village across China.

As part of a U.S. Trade and Development Agency-funded technical assistance program, ILS was supporting Anhui Province in East China in conducting a rural land registration and certification pilot project. China's Ministry of Agriculture (MOA) had coordinated eight land registration provincial pilot projects, all at the village level; the Anhui Province project was one of these pilot projects.

This was the same province that sparked China's last great round of rural land reform in the late 1970s by breaking up rural cooperatives—an experiment in collective farming that by all standards delivered poor results. Anhui Province was the first to provide

land designated with farming contract rights to individual households. This policy produced impressive results. Rural farming income (and nutrition) grew dramatically in the 1980s. It is widely considered to be the most successful rural land reform effort globally because of the sheer scale of people affected.

Yet today China's central government is faced with many challenges related to rural farm lands. First, rural farming household incomes since the early 1990s have not risen at the same pace as urban household incomes, partly because of secured property rights. Urban households have 70-year leases, while rural households have 30-year leases. The income gap is widening, and today the average urbanite earns nearly three times as much as the rural household coun-

terpart. Second, central government authorities are concerned that with rapid industrialization and urbanization, agricultural lands in China are



*Rural land certificates identify agricultural land rights for individual households.*



*Digitized satellite imagery creates a master reference to identify agricultural parcels for rural land registration and certification.*



quickly being converted to factories, apartment complexes, shopping malls, and roads. China must sustain a *red line* of arable land supply to ensure food security for its 1.3 billion people.

Thus, the rural land registration and mapping pilot projects were intended to lead the way to better food security and greater land tenure security for rural farmers. County land records for such purposes as land assessments for subsidy payments do not exist in China today.

AAC clearly defined the assignment—help create a registry system that is easy to use, effective, and not too costly while also mapping all rural lands. In a province with an estimated 13 million households and 100 million rural parcels, this assignment is easier said than done. Together with AAC, ILS laid the groundwork for a functional registry and cadastre, the foundation for any property assessment system. Through targeted educational and capacity-building programs, the Chinese government is expected to commence a profound land and property appraisal program, the result of which could finance rural infrastructure, public services, and land use planning initiatives. Land registration is one key to overall land tenure security, and such pilot projects will help lay the foundation for future fiscal cadastre programs (valuation and taxation).

For such a large-scale rural registration and cadastre system, associated costs must first be evaluated and then the benefits must be defined as well. This article describes how a detailed cost model for a complete rural registry and cadastre was created, and then delineates the benefits for the provincial government, county governments, and rural farmers.

### Modeling Costs

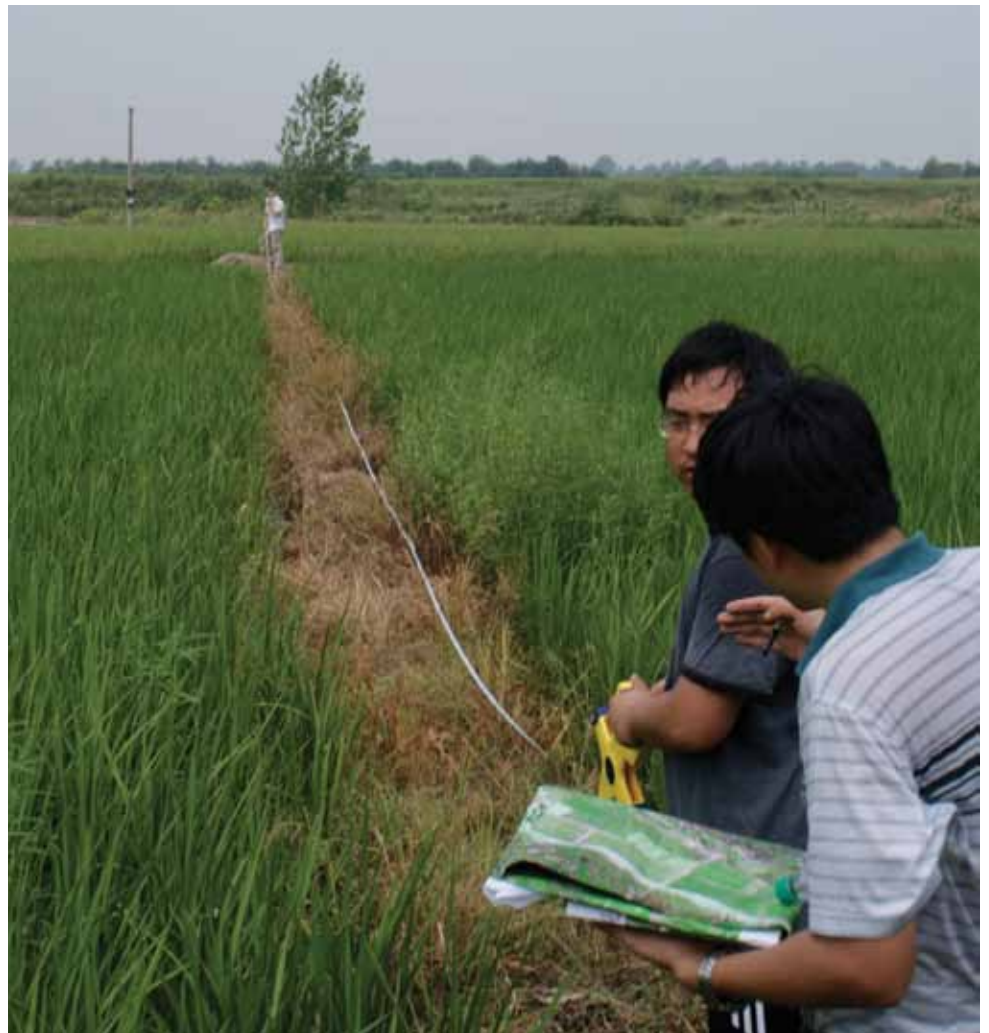
The groundwork for this project involved determining how much a provincial rural land registration system

for specific counties would cost. This entailed much field work and testing of mapping methods and household data collection methods for different geographies. The modeling approach derived costs for a systematic land registration and mapping campaign. Mapping methods included total station surveying, satellite imagery digitization, global positioning systems, and use of measurement tape. Mapping methods were compared based on the time required to collect information, associated error rates, data accuracy, and cost.

It is important to recall the immensity of China's population. China has more than 1.3 billion people, quickly approaching 1.4 billion, making it the world's most populous country. As

such, effective methodologies must be highly efficient. Mass appraisal systems and their underlying techniques are built on the foundation of scalability, making them an ideal fit for a country like China. It was determined that satellite imagery digitization offered very specific cost and efficiency advantages.

Cost categories were defined in the model, including not only mapping but also county and township infrastructure, village labor, public outreach, training, system management, certificate production, and project management. Recall that the challenge as assigned by AAC was also to develop a highly efficient land information management system for use by townships, counties, and the province to capture, store, share, and archive



*Project team members tested the use of tape as one method to measure parcel dimensions. It was demonstrated to be less practical than satellite imagery or GPS.*

rural farming land records inclusive of mapped parcels (the rural cadastre).

Variable, spatially dependent factors drive each of the cost categories. Terrain, population density, agricultural cultivated land area, and the average number of parcels per farmer would all affect the overall cost for a county or township. In other words, registry and mapping costs are not static across geographies, and so the model had to account for spatial variation.

However, there are also fixed costs. A basic amount of computer hardware, software, and system networking is needed for any county to manage and administer land records. Furthermore, training is needed for every county, regardless of how many rural households reside in that area. What varies is the number of people being trained.

An advantage of delineating costs by category is that they may be scrutinized, and by discussing, introducing, testing, and refining methods, costs may selectively be rationalized and reduced. Although parcel mapping and household information collection methods vary by region within China, the basic assumptions and modeling approach are applicable for most, if not all, areas. Common categories allow for a comparative analysis to determine costs and benefits for different provinces. This approach impressed the MOA, which benchmarked and compared all pilot costs by *mu*, a Chinese term of land measurement nearly the same size as a hectare.

Table 1 compares rural land registration and mapping costs for Feidong County—specifically, satellite imagery digitizing is compared to total station surveying for the entire county.

As shown in the table, digitizing is much more cost efficient than total station surveying, representing nearly one-third of the surveying cost. (It is also a more time-efficient method.) Second, AAC was able to identify vil-

lage labor—that is, the cost to hire people to go village-by-village, household-to-household, collecting biographic information (important when assigning rights). This allowed AAC to focus on reducing this cost by further refining methods. Third, county and township infrastructure, which is considered the information management infrastructure, represents together only 12 percent of the total cost using the digitization method. The efficiency gains in labor alone to document, share, store, retrieve, update, manage, and administer land records justify an investment in information management systems.

Feidong County and Jinan District offer an excellent comparison for registry costs. Jinan District, a part of Liu'an Municipality, is smaller than Feidong County. It is a peri-urban area, so it is classified as a district rather than a county. There are 50,000 fewer households in Jinan than in Feidong. Furthermore, there are 1,000 fewer rural households, and the total agriculture cultivated land area is two-thirds that of Feidong. Table 2 compares the total land registration (based on digitization mapping method) for these two areas

The total registry cost is nearly equal. The significant difference is the mapping cost. Jinan District's map-



*A local farmer signs document verifying parcel information recorded on satellite-based imagery.*

ping costs are 10 percent higher than Feidong County's. Unlike Feidong County, which has 90 percent flat terrain, Jinan District is much more representative of Anhui Province because 40 percent of the land is flat, 30 percent hilly, and 30 percent mountainous. Mapping in Jinan District is both more expensive and more difficult.

Note in table 2 that although Jinan District is smaller than Feidong County, the information system infrastructure investment and the system support costs are nearly identical. This is also the case for project management costs. There is slight variation in costs of training, certificate printing, and public outreach. By far the greatest spatial variation is for mapping and village labor, so geography really does matter.

The cost analysis aided project design and subsequent planning, tracking, and financing for land registra-

**Table 1.** Rural land registration and mapping costs for Feidong County

Cost Categories	Digitizing		Total Station Surveying	
	Chinese Yuan	Percentage	Chinese Yuan	Percentage
Village labor	7,350,000	48	7,350,000	16
Mapping	2,988,265	19	37,199,875	72
County infrastructure	1,489,620	10	1,489,620	3
Project management	1,178,500	8	1,178,500	3
Training	934,800	6	934,800	2
Certificate printing	720,000	5	720,000	2
Public outreach	314,000	2	314,000	1
System support	284,383	2	284,383	1
Township infrastructure	172,800	1	172,800	0
Total	15,423,368	100	44,643,978	100
Total USD*	\$2,398,322.83		6,938,058.48	

\*Exchange rate on July 15, 2011: 1 USD = 6.4347 Chinese Yuan.





*An accurate and effective rural land information system is vital to administering agricultural policies in China.*

tion projects as well as communicating registry benefits to policy makers and the public.

### Defining Benefits, Deriving Value

By conducting attitudinal surveys of central, provincial, county, and local

governments, by interviewing farming households in the pilot villages and neighboring villages, and by applying economic logic, some of the perceived benefits of recording and mapping rural lands were defined.

Anhui Province stopped taxing rural lands in the late 1990s and, as part of a government incentive program to protect farmers' lands, now subsidizes farming. Rural households receive agricultural subsidies based in part on the size of land holdings and in part on specific crops. Without rural cadastres and rural land records maintained by counties, subsidy disbursement is a difficult and arduous task. A well-designed and well-maintained land information system will greatly aid the assessed subsidy payment required per household and allow for more efficient disbursement. When farmers were interviewed, this benefit was pointed out to them. A frequent question was, "Will my subsidy payment increase as my land record now reflects a larger land holding?" (The agriculture tax decreased reported agriculture land holdings by rural farmers, naturally.)

**Table 2.** Rural land registration (based on digitization mapping method) for Feidong County and Jinan District

Cost Categories	Feidong County		Jinan District	
	Chinese Yuan	Percentage	Chinese Yuan	Percentage
Village labor	7,350,000	48	6,300,000	40
Mapping	2,988,265	19	4,601,301	29
County infrastructure	1,489,620	10	1,468,720	9
Project management	1,178,500	8	1,178,500	7
Training	934,800	6	881,200	6
Certificate printing	720,000	5	570,000	4
Public outreach	314,000	2	284,000	2
System support	284,383	2	284,383	2
Township infrastructure	172,800	1	211,200	1
Total	15,432,368	100	15,779,304	100
Total USD*	\$2,398,322.83		\$2,452,239.12	

\*Exchange rate on July 15, 2011: \$1 = 6.4347 Chinese Yuan.



*The modeling approach included the use of global positioning systems.*

Counties also benefit by improved land records. Land conversion happens frequently, especially in peri-urban areas. There are many disputes related to the assessed value of lands, and counties would stand to gain through more accurate and modern assessment systems. This would also aid households, especially if they perceive they are gaining a fair market value for their lands.

Today in China rural farmers cannot simply sell their agricultural lands for nonagricultural purposes. It is illegal, and although the Chinese government is moving from a 30-year contract right to an open-ended contract right (a much longer investment time horizon), rural land markets for both transfer and rent are not formalized. In fact, land markets are fragmented. Nevertheless, the invisible hand of markets works through informal channels.

However, having more formal mechanisms to record, transfer, and assess rights will greatly aid rural households. It will improve their abil-

ity to make microeconomic decisions and give them more choices, such as whether to farm, move to a city, rent lands, attempt to aggregate lands to increase output, or invest more income in their lands. These are all benefits of improved land security and formalization of land markets.

### **Project Achievements**

Because of the pragmatic approach taken by the AAC in delineating rural agricultural land parcel boundaries, differing mapping methods aimed at maximizing efficiency while minimizing costs have been tested. The results have indicated that for flat and hilly terrain, the use of digitized satellite imagery is the preeminent method based on cost and time to complete registrations.

By conducting a detailed cost benefit analysis, AAC demonstrated to the MOA not only that the pilot project produced the lowest per-mu cost of all pilot projects in China, but also that this was accomplished through innovative, technology-based solutions. As a result, all households within the two pilot village groups received newly issued certificates from the registry system developed and now operational in Feidong County. This is a tangible success for Anhui Province and demonstrates that the province continues to be a national leader in the field of rural land reform.

This pilot project generated much praise for the AAC by the MOA as an initiative that paves the way for the development of more robust, comprehensive, and scalable land and property information systems that will better manage the area's food security and overall economic vitality. The modeling techniques developed for this pilot project have laid the groundwork for eventual property appraisal based on land market formalization.

Since the project was completed in May 2011, the local township clerk's



*The use of digitized satellite imagery for both flat and hilly terrain is the most economical method for recording parcel data for registration and certification.*

office in Feidong County has been flooded with requests from farmers outside the pilot project villages to obtain new land certificates and to have their parcels mapped too. At the farmer household level, this program to register rural agricultural lands is very encouraging, as farmers will be motivated to manage, protect, and gain from their land. I look forward to returning to that small collective meeting hall in Yangwan village, green fields growing tall, to see that the *seeds* we planted have taken root for a more prosperous future for Chinese farmers. ■

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