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FARMING SYSTEMS AND DEMOGRAPHIC BREAKPOINTS

An Indonesian example: the province of Lampung

Daniel BENOIT & Patrice LEVANG

Demographer Agronomist

Text translated from French by Mrs. B. Nas-Wartelle

ORSTOM Mission, c/o French Embassy, Jalan M.H. Thamrin 20, Jakarta, Indonesia.
ORSTOM, 213 rue La Fayette, 7480 Paris cedex 10, France.

In mostly agricultural countries demographic densities are relevantly indicative of the evolution of the population in relation to the environment. In any given region, maximal densities are related not only to the natural resources and the techniques used for their development, but also to the social customs of the communities living there. Population densities, together with migratory movements, show the breaking points from which, in a given economic system, the land cannot support its population anymore. The province of Lampung, in Indonesia, offers a good example of such demographic pressure (fig. 1).

I. Lampung: a heterogeneous demography

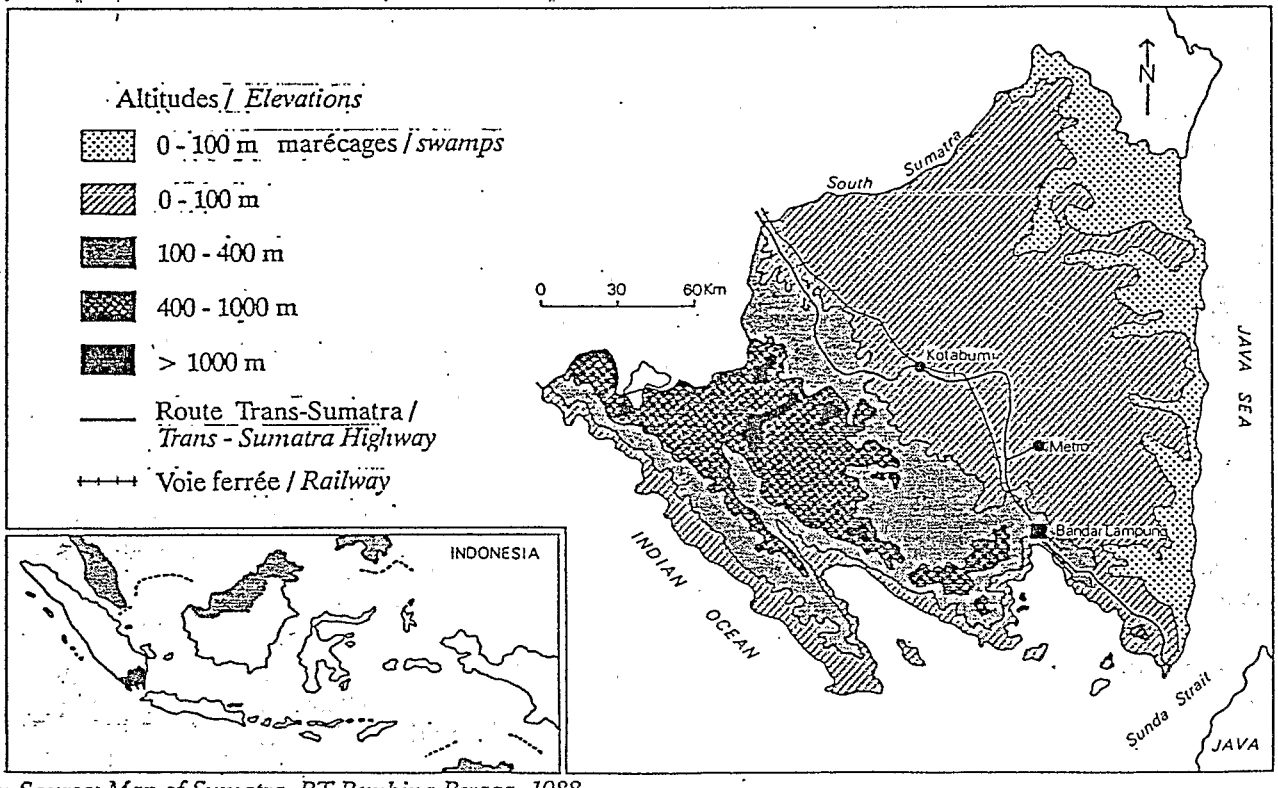
With 5,250,000 inhabitants in 1986, i.e. an average of 180 inhabitants/km^2 *, Lampung is the most heavily populated province in the Indonesian archipelago, after Java and Bali. Outside the protected areas, where any form of settlement is prohibited and which cover 30% of the surface area of the Province, densities range over 250 inhabitants/km^2, an average figure that conceals greatly variable facts. Settlement, resulting from migrations some of which took place quite long ago, has spread unevenly within the Province.

The southernmost part of Sumatra, Lampung is but twenty kilometers away from the Javanese coast. Such a location and the low density of its population in the early century, 15 inhabitants/km^2 in 1930 (Volkstelling 1930, 1935), have made it the privileged destination of peasants in search of land.

The first migrants, in the late 19 th century, were the Sumendo, soon followed in the 1920's by the Ogan, both ethnic groups originating from the mountainous area of the present province of South Sumatra. The coffee boom as well as family traditions among these groups can explain such movements. The Sumendo obey a

* Population densities from Benoit et al. (1989) and the B.P.S. reports.

Fig. 1 La province du Lampung / *Lampung Province*



Source: Map of Sumatra, PT Pembina Peraga, 1988.

Fig. 2 Une démographie hétérogène / *A heterogeneous demography*

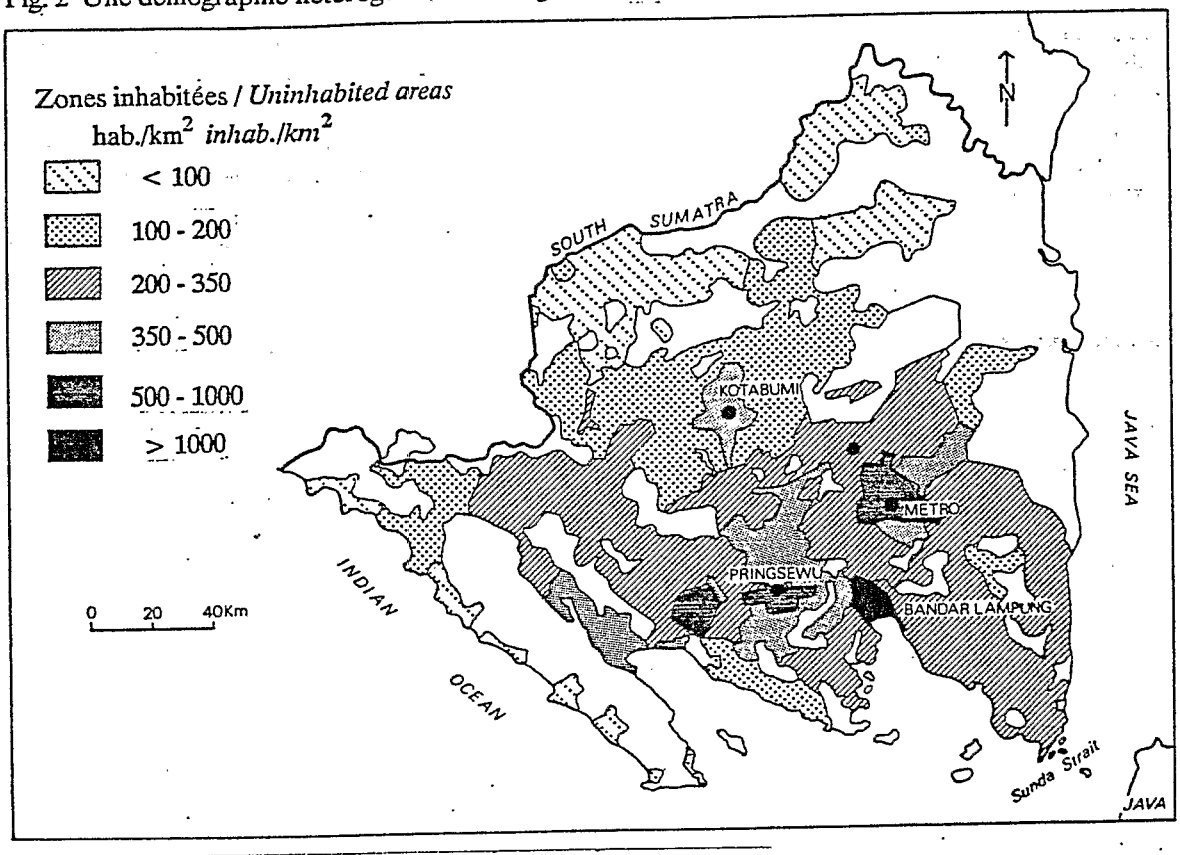
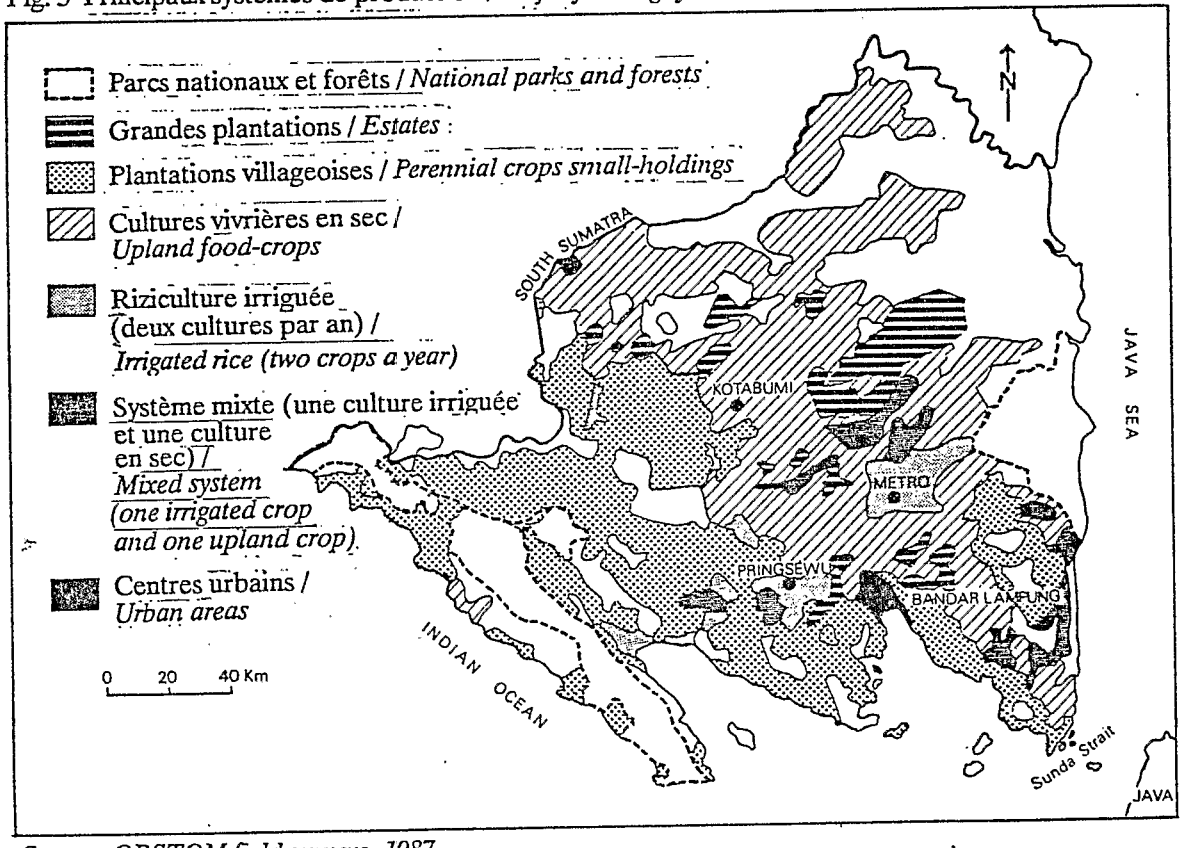


Fig. 3 Principaux systèmes de production / *Major farming systems*



Source: ORSTOM field surveys, 1987.

matrilinear system according to which the eldest daughter inherits most of the family property, and this consequently compels the other children to emigrate. Up to now, their route has followed the range of the Barisan Mountains, a major axis in the island of Sumatra.

Javanese and Sundanese constitute the second wave of migrants. As early as in the last century, the impoverishment of Javanese farmers led the Dutch colonial authorities to seek virgin areas liable to receive many a landless peasant. Within the vast farming colonization program called *kolonisatie*, Lampung was selected as the privileged destination, especially for the regions of Pringsewu-Gading Rejo where settlement started in 1905, and later of Metro in 1935 (Peltzer, 1945). After the Independence, movements of population from Java and Bali will go on under the name of Transmigration, with important fluctuations until the end of the 1970's (Hardjono, 1975; Levang & Sevin, 1989). After that will follow organized migrations within the Province itself (local Transmigration).

However, migrations planned from Java or Bali towards Lampung have not brought more than 20% of the immigrated Javanese population actually resident in the Province. Since the turn of the century, spontaneous migrants have kept swarming into Lampung.

The result of such movements is an average population growth rate of 5% per year between 1930 and 1985 (Volkstelling 1930; B.P.S. & SUPAS 85). The diversity of the migrants' ethnic and geographic origins and various types of migrations (spontaneous or induced by the government) have brought about uneven populating movements over the Province where settlement now is quite heterogeneous (fig. 2).

Densities range between 10 and 1200 inhabitants/km^2 (not counting the provincial capital Bandar Lampung). Four zones can be considered:

- the peneplain, where densities reach "Javanese levels", organized around the historical centers of *kolonisatie*, Pringsewu and Metro. Figures run over 500 inhabitants/km^2 and in some places are even higher than 1,000 inhabitants/km^2. Javanese and Sundanese groups are the majority there (80 to 95% of the population);
- the mountain (Barisan range), the northern border of the peneplain and the east coast. Densities here go up to 350 inhabitants/km^2 and never under 100. If the Javanese are the most important group here too, Sumatranese populations, mainly Sumendo, Ogan and Abung, are found in significant numbers. All the allochtons are spontaneous migrants or their descendants;
- the west coast (Pesisir, Balik Bukit) is the only region where an autochthonous ethnic group (Lampung Pesisir) still forms the majority of the population. Densities there are the lowest to be found in Lampung (18 and 38 inhabitants/km^2) in 1985, they never reach 100;
- the northern part of the Province, settlement zone of local Transmigrants. Until 1960, this area only provided emigrants. It was not before the Transmigration programs were set up, particularly those of local Transmigration, that people "immigrated" there. Thanks to them, densities now vary between 35 and 60 inhabitants/km^2. Settlement is mostly Javanese, with some native villages, Mesuji and Way-Kanan, mainly along the rivers.

A comparison between figures 2 and 3 will clearly show how closely population densities and farming systems are related.

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II. Major farming systems

Sparsely populated areas (50 to 350 inhabitants/km^2) offer farming systems based either on perennial crops, such as coffee, pepper, clove, *damar* (*Shorea sp.* resins) and rubber, or on upland food crops such as upland rice, intercropped with maize and cassava. Heavily populated areas (500 to 1,100 inhabitants/km^2) rely exclusively on irrigated rice with two farming seasons a year. Medium densities (between 300 and 800 inhabitants/km^2) will produce various systems often associating irrigated rice farming for the first season of the year with upland food crops (maize, peanut, soya, etc...) for the second (fig. 3 & 4).

The distribution of the different farming systems over the land space results from three major factors: soil fertility, ethnic origin and irrigation.

The native Lampung population, and later other Sumatranese groups, mostly Ogan and Sumendo, very naturally settled down on fertile lands: alluvial plains along the large rivers and their main affluents, and mountainous areas of the Barisan range where andesitic and basaltic mother rock gave birth to rich soils. Highly suitable for slash and burn upland rice farming with secondary forest fallow, such lands have also proved particularly propitious to pepper, coffee and clove growing.

In the large eastern peneplain which occupies 2/3 of Lampung are found leached ferralitic soils derived from acid tufa. Despised by the native populations because they tend to be easily invaded with *alang-alang* (*Imperata cylindrica*), theses lands are but seldom developed. Surely enough those huge, almost empty, territories became the target of the great Javanese farming colonization projects, Dutch *kolonisatie* at first, then Transmigration after the Independence.

Where there is no irrigation network, Javanese farmers resort to the traditional *tumpang sari* system, in which upland rice, maize and cassava are cultivated on the same plot with one yield only a year. Where a network does exist, its quality will determine the number of yields of irrigated rice. Too often, an excessive extension of the network will not allow an extra yield of rice which is then replaced with an upland crop: maize, peanut, soya or golden gram.

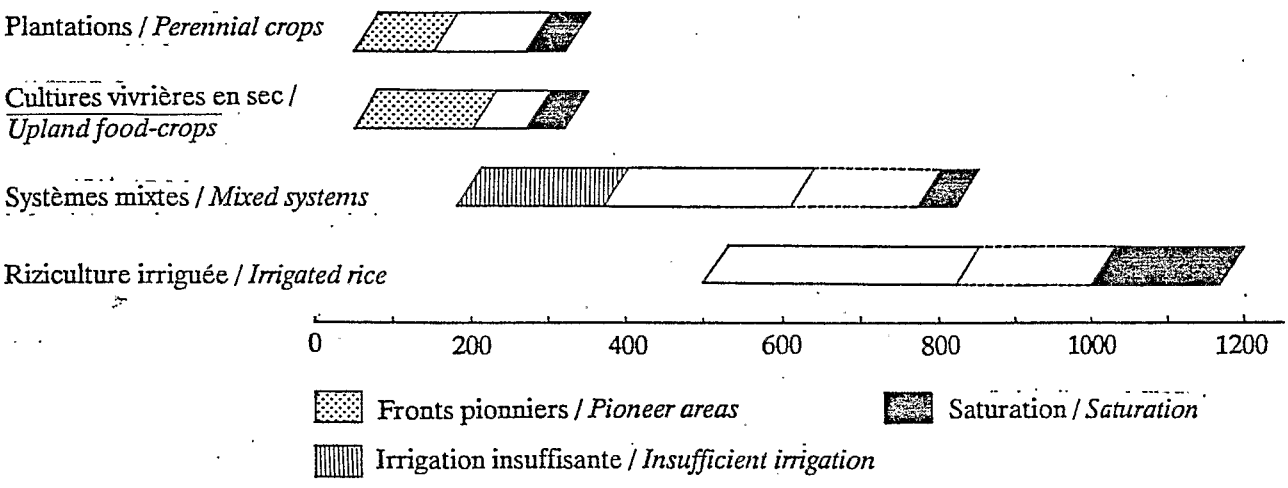
The technical requirements and economic results of each major farming system are easily differentiated. They vary greatly within each system too, depending on local and cultural features, on access and trade facilities, job opportunities, etc. We will here endeavor to describe the main characteristics of the major systems.

1. Farming systems based on upland crops: coffee and pepper.

In Lampung, pepper, coffee or clove plantations were developed at the expense of a much older system: upland rice shifting cultivation.

Until the late 19th century, the needs in food crops of the local populations were met with one yield of upland rice a year on clearings of 1.4 ha. on the average per family (Levang et al., 1982; Levang, 1983). Left to natural forest regrowth after one cropping season, these areas are only put to use again at the end of a long forested fallow period of 15 to 20 years. Bush products such as *damar*, dragon's blood and rattan, provide each household with a modest income. Pepper, which is grown almost exclusively along the main rivers, is the only cash crop available to the Lampung people, and probably has been since the 16th century (Marsden, 1783).

Fig. 4 Systèmes de production et densités démographiques / *Farming systems and demographic densities*



Source: ORSTOM Field surveys, 1987.

Since the beginning of the 20th century, the construction of the Tanjung Karang-Palembang railway and the upgrading of road and harbor facilities have helped towards the distribution of manufactured goods from Java and the marketing of farming produces from Lampung. The quick development of coffee and hevea plantations provides the necessary cash to the local populations (Broersma, 1916; Scholz, 1983).

Implementation techniques used on plantations are much the same today as they were then. The *ladang* is not left to forest regrowth after harvesting the upland rice, but is rather planted with coffee trees and/or pepper props. Saplings thus greatly benefit from the nutrients found in the ashes after clearing. Chemical fertilizers or pesticides are seldom resorted to.

The main difficulty when setting up a plantation is to ensure its maintenance during the 3 to 6 years that will elapse before it gives its first harvests. If the upland rice yields are enough to retribute labor used for clearing and planting, the maintenance of a yet non-productive plantation demands considerable investment: 6 to 12 weedings a year. Calling on family labor implies that the basic needs of those families are satisfied, which is not often the case.

Calling on wage earning labor likewise implies that the planter receives a sufficient income, from other plantations for example, and also that he can plan ahead long term household expenses. Which seldom is the case as well, and the planter may have to dig into his landed estate capital to meet the deal.

For 5 to 10 years, the rate of production will stay high. Then, owing to the lack of pruning and cutting back of coffee trees, and to problems linked with the replacement of dead pepper plants, production will shortly fall back. Planters tend to postpone as late as possible the time when inevitably they must replant their land. Plantations that are too old will yield less and less. When production cannot cover the maintenance costs anymore, such plantations are simply left to die.

Another obstacle, and not the least, arises from the huge variations, from one year to the next, on the price of commodities, mainly exported ones such as coffee and pepper. The planter has no control whatsoever on the quotation changes. Booms after recessions are not uncommon, which explains why planters are not too eager to run into debt to start or improve a plantation.

The economic results of the system depend greatly on plantation ages and on commodity prices. In 1987, for an average area of 1 to 2 hectares, a family could expect a 1 to 1.5 million rupiah income*. Following in 1988 a dramatic raise due to the boom on pepper, the average income fell back to 1 million rupiahs in 1989 after the collapse of coffee prices.

However, the income a planter's family draw from coffee or pepper, even if the plantation is poorly maintained or already in a recession stage, remains much higher than that drawn from continuous upland rice farming.

2. Upland food crop farming systems.

Neglected by the native populations because of their low fertility, the leached ferralitic soils of the large eastern peneplain are left to the great Transmigration projects. Given two hectares per family, thousands of Javanese peasants have been installed there with government money in the hope that they will bring out the productivity of those vast areas invaded by *alang-alang*.

That was granting too much credit to the Javanese farmer's reputation of excellency and not enough to the essential influence of an exceptional environment: the incomparable fertility of Javanese soils. Transplanted into Lampung's less favorable conditions, the traditional Javanese system *tumpang sari* will encounter serious difficulties.

Even if the first year's output is rather satisfactory, the situation is rapidly degrading in the following years. Surprisingly enough, the Javanese peasant has

* All data on household incomes from Benoit et al. (1989). In 1987 U.S. $ 1 = Rp. 1600.

managed to contain the *Imperata* by hoeing the soil twice, sometimes three times, and uprooting the rhizomes. But on the other hand, the fast development of short-cycled herbaceous weeds requires a lot of weeding time which the transmigrants' families can seldom spare. The rate of organic matter of the soil quickly decreases, which in turn increases leaching and reduces the effect of fertilization. In these pioneer zones, the sudden appearance of wide planted areas attracts a great many predators such as wild boars, stags and elephants, and brings about the proliferation of all kinds of pests: stem borers, bugs, rats, etc...

Most often from the second year on, the family's food supply is not provided by the harvests anymore. The farmer is then compelled to seek work outside and stays away for increasingly longer periods at a time. The land plot is not properly kept in his absence, the rice and maize output drops, only cassava remains productive. Because of his low income, the migrant tends to opt for the monoculture of cassava with no restitution of manure to the soil. After five to ten years, even cassava can barely grow out of these exhausted soils. *Alang-alang* then reappears on land plots that have been gradually abandoned. As to the migrant, he has turned into an unskilled laborer or a farm hand working for agro-industrial estates judiciously established in the vicinity of major Transmigration centers.

In 1987, the *tumpang-sari* system gives a net income of about Rp. 230,000/ha. per year. That same year, in the Metro area, on similar, but irrigated soils, a rice grower will get an income four times higher in only one ceopping season.

3. Two-season irrigated rice farming systems.

The association of Dutch engineers with Javanese rice growers gave birth to the first irrigated perimeters in Lampung within the *kolonisatie* programs from 1905 on.

Until the late sixties, farmers used rice varieties that allowed only one yield a year. The second season was devoted either to secondary crops (*palawija* in Indonesian), or to a grazed fallow.

From the start of the years 1970, the Green Revolution radically transformed farming systems in irrigated areas. Through the *BIMAS* programs*, selected varieties, chemical fertilizers and pesticides granted by the government were quickly adopted by the peasants. The more recent introduction of pre-emergence weed-killers also knew a rapid success.

Over a comparatively short period of some ten years, the rice growers tremendously expanded their technical capacity. But the same techniques, brought to upland crop farming areas, had no success with the peasants.

The use of irrigation alone enables farmers to obtain steady yields of over 2,000 kg of paddy per ha.. Fertilization on short-cycled varieties allows two crops of rice a year and provides average yields of 6,000 kg of paddy per ha.. The reasonable use of pesticides as a preventive means helps to avoid unwanted inter-annual fluctuations in output.

On an average area of 63 ares of paddy-field, the annual income of a family in the region of Metro reaches over 1.5 million rupiahs in 1987.

Unlike with upland crop farming, here the rice grower can count on his output, hence on a minimum income. A gradual mastering of the main factors of production enables him not only to increase outputs but also to ensure their stability. The concept of risk must be taken into account to understand the attitude of the farmer faced with new techniques. The behavior of peasants in zones where irrigation allows but one yield of rice a year is a perfect example of such confrontation.

4. Mixed systems: irrigated rice and upland crops.

Mixed systems are to be found mainly in two cases:
- the extension beyond its real capacity of a regional irrigation network;

* BIMAS: abbreviation of BImbingan MASsal, a system of farming credits in kind.

- small village-size networks without large reservoirs.

In both cases, irrigation is not provided during the dry season.

In all respects, the situation in such areas can be seen as an in-between, compared to the two previously described systems, whether it be regarding the population pressure, the standard of income, or the technical ability of farmers. The first farming season only offers relative security to the farmer. The second one fosters even a higher risk than that taken in the *tumpang sari* system, because it concerns upland crops and takes place at the end of the rainy season.

In 1987, the average annual income of a family involved in a mixed farming system reaches about Rp. 800,000 .

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We have seen that in Lampung the existence of a given farming system in a region is due to the conjunction of three factors: soil fertility, ethnic origin of the inhabitants and presence of an irrigation network. Within the same system, significant differences can be noticed according to how long the area has been populated, to its accessibility, the quality of its infrastructures, etc.

In zones of old native settlement mostly devoted to small plantation systems, the rather low prices on land and the need for labor have caused important spontaneous migration movements from Java. In other regions, the large colonization centers have led to the development of huge, mostly Javanese populated areas, and have become the magnets of spontaneous immigration.

On the whole, the older the immigration from Java, the higher the demographic densities. The Javanese population does not progress steadily but in rushes. These occur as if the land were divided into close-bound districts, the size of a dozen villages. Each district gradually grows until it reaches its population maximum. Only when the situation becomes unbearable will people migrate to the neighboring areas, as yet untouched.

III. Saturated systems: the breaking points

Once limited to the proximity of major colonization projects, spontaneous Javanese immigrations have spread, since the 1960's, to plantation zones traditionally occupied by native Sumatranese populations: Lampung, Sumendo and Ogan.

1. Plantations: towards the end of extensive farming systems.

Given the conditions in Lampung, changing from slash and burn to plantation farming requires an important labor input, especially for the harvesting of coffee, pepper and clove. Up to the years 1960, seasonal farm hands from Java did the work. The extension of plantations called for extra hands to ensure their maintenance and whole hamlets of Javanese laborers were erected on the plantations. Mother-villages along the roads and rivers remained inhabited almost exclusively by the native populations.

This first nucleus of settlement will allow masses of migrants to come looking for work, but mainly for land. Very few can afford to purchase a plantation. But forested parcels, away from the villages, can be obtained at a very reasonable price.

It is common practice, in order to buy land, to borrow a parcel of about 1 ha. for a three year period, and turn it into a coffee plantation. The tenant subsists more or less on cover crops: maize and cassava mostly. At the end of those three years, when the coffee shrubs start to yield, the parcel is divided in two lots: one goes back to the owner, the other becomes the tenant's property. Such an arrangement is satisfactory for both parties. The Javanese has been made a landowner with his work power as sole investment, the Lampung has got a plantation without any effort on his part.

More and more migrants are attracted by the possibility of becoming landowners, while the native Lampung, new to the idea of land value, gradually loses his landed estate capital. For a Javanese coming from an overpopulated area, land has a value in itself. For the Lampung, a land plot is worth only its contents or its short distance to the village. Except in the rewarding

times of harvest, in case of an urgent need of money, to pay hospital or school tuition fees for example, the planter will be compelled to whittle down his only capital: land.

Such circumstances lead to distinguish three kinds of family:

- **wealthy families:** these are almost always natives who own a large landed estate capital, plantations and paddy-fields. Quite often they will engage in secondary activities: people or goods transportation, rice processing or marketing of farming produces. Real clans of gentlemen-farmers, some may employ several dozens of farm hands and share-croppers on a permanent basis;
- **smallholders:** these are either long established Javanese migrants who settled there when land prices still ran low, or ruined natives left with only a few plantation parcels;
- **farm laborers:** those were the last to come among Javanese migrants. Higher prices now forbid them to buy land. Competition between farm hands no more allows high daily wages nor does it make it possible to exchange one's labor for land.

The system becomes saturated when recent immigrants cannot find work as farm hands. This occurs when the population density reaches 300 to 350 inhabitants/km^2. All available land parcels have then been turned into plantations with full employment. Labor is at its minimum cost. If a farm hand were to accept lower wages, he would not be able to support his family anymore.

There is however a certain fluctuation in the maximum demographic pressure a system can bear, according to the quotations on commodities. That is, when coffee or pepper prices are high, planters are ready to hire farm hands with a one-year contract in order to ensure the good maintenance of their plantations. For 10 to 12 weedings, the usual salary, per hectare and per year, will consist of 100 kg of white rice, given out in monthly installments, and 100 kg of coffee when harvested. Although rather costly for the planter, this method enables him to pay after harvesting, a favorable time when cash is available, while providing against the eventuality of a collapse in prices.

On the other hand, during recession periods owners are reluctant to invest into old or meagerly productive plantations, which has an immediate effect on job opportunities and consequently on the maximum demographic load.

2. Upland crop farming systems: the attractions of land ownership.

Transmigration zones devoted to upland food crops reveal their inner contradiction from the start. Food crop farming very seldom grant families their self-sufficiency. An outside job alone will somehow help to make up for the deficiencies of farming production. And yet population densities keep rising fast, up to reaching 300 to 350 inhabitants/km^2. The development of Transmigration centers acts as a magnet for spontaneous migration. In many of them, 10 years after their creation, official migrants represent only 15 to 20% of the population. The majority of families consist of spontaneous migrants who bought their parcels from transmigrants or settled on neighboring reserved areas.

The average surface owned by migrants is thus rapidly falling from 2 to 1.5 ha. There are only slight divergences from that average, properties larger than 2 ha. or smaller than 1 ha. being seldom encountered. Taking out 25 ares for the *pekarangan* (house-plot comprising an orchard garden around the house), only 125 ares are devoted to food crop growing. The average income drawn from farming activities rarely runs higher than Rp. 300,000 a year per family.

But if upland rice, maize and cassava outputs are not sufficient to support his family, they are enough to grant the migrant the status of farmer. From farm hand in Java, his accession to ownership has enabled him to climb one step on the social ladder. Whether official or spontaneous, the migrant's main goal is to free himself from his previous condition of laborer.

His calculation is not made from the financial point of view: as an independent farmer he seldom makes more than Rp. 500 a day, whereas a daily laborer's income is about Rp. 1500. Similarly, many a spontaneous migrant will rather purchase poorly fertile soils which will entitle him to a certificate of ownership, than fertile land without that precious paper. Now in the outer islands

of the archipelago, such certificates are not usually delivered outside Transmigration areas.

The head of the family always introduces himself as farmer, not as farm laborer. He tends to conceal the importance of the "minor" and "occasional" income drawn from outside jobs. A close examination of his statements reveals that those "minor" revenues often represent over 75% of the household income. True, farming activities, even if not profitable, are given a priority. His 125 cultivated ares provide full-time employment to the head of the family, with the help of one or two other members for the peak periods. Outside these periods, at least one member of the family has to work as daily laborer on sugar-cane plantations or other large estates. Such jobs generally fall on the young people, sometimes on the father if the children are too young, seldom on the wife. Too many youth thus jeopardize their future by early dropping out of school to become farm hands.

It looks as if those outside jobs, held by a few members in the family, were meant to support an unprofitable farming system, with the sole purpose of granting the head of the family the status of landowner.

3. Irrigated rice farming: Javanese densities.

On the irrigated perimeters of Gading Rejo-Pringsewu developed between 1905 and 1927, the Dutch authorities allotted parcels comprising a *pekarangan* and one *bau* of paddy-field per family. A *bau*, measuring 70 ares, is then considered as the standard surface on which to ensure the full employment and subsistence of a family.

Until the end of the years 1970, with one crop of irrigated rice a year followed by a grazing fallow season, no farm can survive if the land is parcelled out. The introduction of high-yield, short-cycled varieties, together with chemical fertilization, make it possible to double the average yield per crop, and to realize two yields a year.

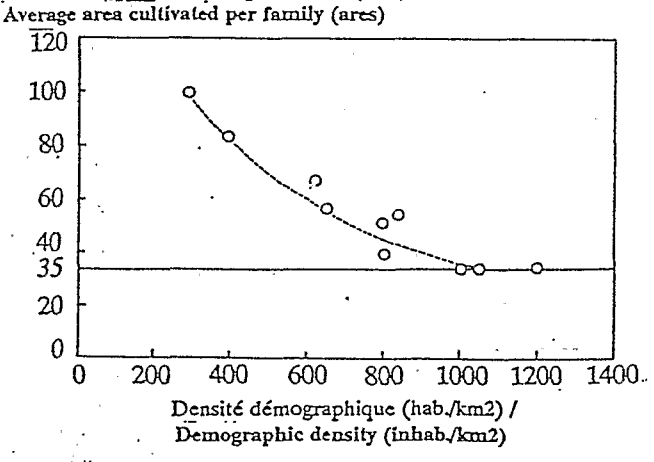
From then on, the land being able to support a greater number of families is rapidly parcelled out. Lots of a *bau* at first are themselves always divided in two. Nowadays, parcels of 70 solid ares have virtually disappeared. Most of them cover 1/2 or 1/4 of a *bau* (35 and 17.5 ares respectively). A further dividing would be of no interest, such surfaces being already inferior to the minimum viable one.

In theory, it should be possible for a family to farm only 17.5 are and complement its income with outside revenues. This is forgetting the farming peak periods, which forbid any external wage-earning employment, and the lack of job opportunities outside those periods. Such circumstances have driven heads of family to seek a wage-earning job while leaving their parcel in the hands of a share-cropper. Figure 5 will show the evolution of the average cultivated surface per family related to demographic pressure. From a density of 1,000 inhabitants/km^2 upwards, the average surface of cultivated property per family asymptotically tends towards 35 ares.

This can be considered as a breaking point: on an average surface of 35 ares, a rice-grower cannot keep a couple of ox or buffalos anymore. Competition is high to graze on the grass and weeds of the roadside. Full employment is not guaranteed in farming and competition is high as well for daily labor jobs. If there are no small factories in the neighborhood (tile and brick works...), the peasants have no choice but to invest more pains into their own parcel.

Dividing the meager family property for children to inherit their share is impossible and many young couples resort to share-cropping. In irrigated rice farm-

Fig. 5 Seuil de rupture en riziculture irriguée / *Breakpoint in irrigated rice cropping*



Source: ORSTOM field surveys, 1987.

ing systems, half the yields traditionally fall back to the owner. When pressure on the land is high, inputs are almost always paid by the share-cropper. Therefore, if owning a 35 are paddy-field provides enough food for a family, the share-cropper will have to find at least 50 to 70 ares for the same result.

Such figures bear out the reality of a breaking point of land surface around 35 ares for irrigated rice-growing. The maximum number of farmers the system can stand has been reached. Newcomers, whether migrants or young couples, will encounter the greatest difficulties in finding farming jobs. They will have to seek employment in a local factory, if any, or to emigrate to a town or the pioneer fronts in the North of Lampung.

4. Mixed farming systems: an in-between situation.

Mixed farming systems, exploited to the utmost, remain the perfect balance between upland and irrigated farming. Even with the highest population densities (800 inhabitants/km^2), the average cultivated surface is practically never inferior to 75 to 80 ares per family. The factors described for irrigated systems remain valid here, but the breaking points are higher, only one crop of rice being produced per year.

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Whatever the system involved, saturation is obvious when emigration is strong or even relative (when demography is lower than natural population growth). Such a situation is clearly observed in easily accessible plantation zones as well as in very old colonization areas.

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In 1905, when the first census was taken, the population in Lampung amounted only to 160,000 inhabitants. In 1986, there are over 5,250,000 inhabitants in the Province where the rate of population growth is the highest of the archipelago. Densities of more than 1,000 inhabitants/km^2 are found next to densities inferior to 50.

Among the reasons offered to explain such differences, soil fertility usually comes first. Mohr (1938) gives very interesting conclusions on the relationship between densities and soil fertility on the island of Java. However, the comparison he makes between Java and the outer islands now seems doubtful, the farming systems described being entirely different. Rather than soil fertility, the choice of a farming system will determine the maximum population pressure of a region.

The ethnic factor, through the choice of a farming system and the family traditions, is as important as soil fertility. For example, areas of low fertility where Javanese migrants have implemented the *tumpang sari* system can show the same densities as more fertile zones where native Lampung people grow coffee.

Irrigation plays a decisive part, for it makes it possible to neglect the soil fertility factor. In all upland food crop farming areas where irrigation has been introduced, population densities have doubled in ten years.

For each farming system, it is feasible to determine the breaking points of demographic pressure. Once these are reached, a region cannot absorb any more newcomers, immigrants or young couples, except if the farming system is to be modified.

On plantations, the breaking point is around 350 inhabitants/km^2. At that level, the land market is saturated and all wage-earning farm laborers are fully employed. The system could feed more people owing to the relatively high income drawn from the plantations. But it could not ensure their full employment. It is the financial capacity of landowners to hire wage-earning laborers which alone determines the demographic breaking point of plantation systems.

The breaking point in irrigated rice growing, because the system calls for more labor, will be higher, around 600 or 1,000 inhabitants/km^2, respectively, depending on how many farming seasons, one or two, can be realized. At such densities, the land market stagnates, not from the landowners' doing, but because it has become impossible to further parcel out paddy-fields.