

GREEN GOLD AND ICE: THE IMPACT OF FROSTS ON THE COFFEE GROWING REGION OF NORTHERN PARANÁ, BRAZIL

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On a bitterly cold night in late July, 1975 the temperature plummeted below freezing for a number of hours in the coffee zone of the southern Brazilian state of Paraná. Several days later it was reported that 70 percent of the region's coffee crop was destroyed and that an undetermined number of coffee trees were killed during the frost – purportedly the worst within living memory. But the 1975 frost was only the most recent, albeit, the most devastating, of a long series of frosts and freezes that have plagued the inhabitants of Paraná, the largest coffee growing region in the world.

The latest frost received widespread media coverage which centered on its implications for world coffee prices. Little attention was given to the frost's immediate or future effects on the economic institutions of the communities where it took place. Although I have not visited northern Paraná since the 1975 frost, it is possible to predict its impact will follow the pattern of other recent frosts in the coffee zone of the state. Ouro Verde [1] a representative coffee growing community in northern Paraná, will be the focus of this discussion. I carried out field research there in 1967–1968 and in 1971 following a series of major and minor freezes that had greatly affected the local population, and had, in part, been responsible for a change in the community's economic base.

Before turning to the social and economic repercussions of frost in Ouro Verde and elsewhere in Paraná, it is essential to understand exactly what impact freezing temperatures have on coffee trees. In addition, the history of frosts will be outlined in order to demonstrate that frost as a disaster agent is neither a recent nor an uncommon scourge in Brazil's coffee zone.

FROSTS IN BRAZIL

In the coffee region of Brazil frosts are classified into two types according to their intensity. *Geadas brancas*, also called *geadas sapecar*, ("white" or "singeing" frosts), are relatively mild frosts which only "burn" [2] the topmost branches of the trees and have little affect on the size of the subsequent harvest. *Geadas negras* ("black" frosts) are severe frosts which greatly reduce or entirely eliminate the following harvest(s), and sometimes kill the coffee trees. Even when a severe frost occurs, however, it only does permanent damage if it immediately follows a rainy period when the tree's leaves and trunk are still wet. In such cases, water in the trunk's cells freezes and the cells are ruptured by the expansion of ice; eventually the trunk splits. When this occurs, the only remedy is to cut the tree down to within one or two feet of the ground in the hope that it will eventually

sprout new branches. “Black frosts” that follow dry periods do not damage the trees in this way, but they can be responsible for the loss of from one to three harvests, depending upon their severity.

Owing to its location in the most tropical part of Brazil’s coffee zone, the Paraíba Valley in the state of Rio de Janeiro, which witnessed the nation’s first coffee boom in the mid 19th century, escaped the freezing temperatures that play havoc with coffee cultivation. Due to a variety of other climatic and economic factors [3], however, coffee cultivation in the Paraíba Valley had met its demise by the end of the 19th century, a time when the second phase of the boom was well underway in the interior of the state of São Paulo. It was in this more southerly region that coffee trees were first subject to the vagaries of temperature – with sometimes disastrous results. Although the degree of frost damage was mediated by such variables as altitude, wind velocity, and prior rainfall, and varied from one area of São Paulo’s coffee zone to another, a series of “black frosts” in 1870, 1902, 1918 and 1943 greatly reduced the size of the subsequent harvests, and, in some low lying areas, destroyed the trees. For example, after the frost of June 1918, the state’s coffee production declined from 12.5 million sacks [4] of coffee in 1917–1918 to 7.2 million sacks during the 1918–1919 harvest, and 4.1 million sacks the following year (Monbeig, 1952:59). These frosts, along with depleted soils and fluctuating coffee prices, have turned many former “coffee counties” in the state to other economic activities.

The most recent site of Brazil’s coffee boom, the northern portion of Paraná state, is also the one most subject to frosts. It is here that the 1975 frosts had such devastating effects; but, once again, this was not a unique event. In 1942, 1955, 1963, and 1969, “black frosts” swept through the region destroying

millions of newly planted coffee trees and eliminating harvests. And in many parts of Paraná’s coffee zones there are minor freezes every year. Although they do not destroy the trees or obliterate harvests, they still reduce the size of yields.

One may well inquire why coffee cultivation expanded into so climatically unsuitable a region. The answer is rather complex and involves governmental policy towards coffee cultivation, the crop’s price structure, the availability of inexpensive virgin land, and the fact that a substantial portion of northern Paraná is covered with *terra roxa*, a dark red porous soil on which coffee trees thrive.

The initial impetus for the spread of coffee cultivation into northern Paraná came at the beginning of this century when government authorities distressed by the over-production which had led to lower coffee prices, banned the planting of new coffee trees in São Paulo. This ban did not extend to Paraná, however, and its rich *terra roxa* soil beckoned cultivators from the older coffee regions. Then too, the prices received for the crop, at least until the 1921 crisis, were very high. And over the last several decades, despite rather wide price fluctuations, government price supports continued to insure that coffee prices did not fall precipitously, while the returns on alternative unsupported crops – cotton, rice, beans, etc. – have fluctuated greatly in accordance with the laws of supply and demand. Hence, no other crop could compete with coffee in terms of profitability even during periods of relatively low prices [5].

The availability of vast expanses of inexpensive fertile land attracted numerous cultivators to Paraná. Yields were high for at least the first few years after the trees came into production, and if frost damaged the trees or seriously diminished their harvest, one could move on to newer lands just opening up for cultivation. In fact, there is no question that availability of unoccupied land in northern

Paraná, in conjunction with the relative high prices paid for coffee, invited encroachment onto frost-prone tracts (Margolis, 1977) [6].

GREEN GOLD AND ICE IN OURO VERDE

During the winter months of 1966, frosts and the possibility of freezing temperatures were frequent topics of discussion in Ouro Verde, then a county of some 10,500 people, located about 32 miles northwest of Maringá in the state of Paraná. At the end of July of that year, there was a frost scare while I was living on a farm in the region.

As the sky darkened toward evening a cold chill fell and a night-long vigil began. A group of farmers had gathered to drink *cachaça* (a strong alcoholic drink made from sugar cane), and discuss the possible losses they would incur if it froze. Every five or ten minutes one would go out to look at the thermometer and report. As the temperature inched downward, an air of anxiety began to fill the room; when it fell below zero (Celsius), all those present silently crossed themselves (Margolis, 1973: 46).

This turned out to be only a “*geada branca*”. Nevertheless, those most affected lost up to half their crop.

On my return to Ouro Verde in 1967–1968, local residents were again preoccupied with frost hazard as the winter months drew near. Most people who had lived in the coffee zone for two or three decades could list the exact dates and degree of damage wrought by major frosts, and they began comparing current weather conditions to those which had preceded the most infamous “*geadas negras*”. In May 1968 it was unseasonably cold, but it warmed up considerably in June. Some claimed that this was the same sequence of temperature changes that took place before the 1963 frost, while others scoffed, saying “there is a frost scare every year”.

Frosts are blamed for all manner of problems in Ouro Verde, particularly the decline in coffee production. “It isn’t the people, but the frosts that have ruined agriculture”,

said one local resident [7]. “The major sickness in Paraná is the frosts. If it weren’t for them Paraná would be the richest state in Brazil”, claimed another. One farmer likened the frost to time bombs; if they explode, an individual’s livelihood can be affected for years to come:

If it freezes there are three years of disaster, and one good harvest does not compensate for these three years. Before it froze my trees were like jewels, the most beautiful thing in the world. But afterwards, I didn’t even have enough coffee to drink.

This is an over-simplification of the agricultural problems in the community since not only frosts, but soil depletion and profit margins reduced by lower coffee prices also have affected the economic well being of Ouro Verde. Still, frosts are a significant contributing factor.

Frosts have been a serious problem for coffee cultivators in Ouro Verde almost since the time of the county’s founding in 1952. In late July, 1955 the temperature fell to -5°C , killing many of the coffee trees that had just begun producing their first harvest [8]. The aftermath of another major frost in 1963 was a harbinger of things to come. In that year a few hours of freezing temperatures wiped out the coffee harvest in the lowest-lying area of the county. In response, one large property owner, whose 100,000 coffee trees were thoroughly “burned”, cut them down and planted pasture. Many small-scale landowners who lacked enough capital to carry them over to the next harvest sold their holdings for rather low prices. Buyers consisted of the fortunate few whose plantings had escaped the worst effects of the frost, and wealthy landowners seeking to establish or expand their ranching operations.

These events transformed the economy of Ouro Verde. Land consolidation and the concomitant change in the economic base from coffee cultivation to cattle ranching continue apace as frosts, soil depletion, and

uncertain coffee prices make the long-term devotion to “green gold” an ever more dubious proposition. The rise of the cattle industry in the county is correlated, in part, with declining yields due to frosts.

Cattle holdings, dating back to the founding of the community, have recently grown sizeably. This trend is related to frost cycles. During most of the 1950’s, the number of head fluctuated between 1000 and 1500, while from 1959 to 1960 that figure more than doubled, and between 1963 and 1964 it tripled. By 1971, there were over 25,000 head of cattle in the county. More recent figures are unavailable, but, the developments to which I refer would suggest that cattle have assumed even greater local economic importance since the “black frosts” of 1975.

Frosts also have contributed to declining yields and the subsequent shift to cattle in another way. Simply put, the constant danger of frosts discouraged most farmers from investing in costly fertilizers for their coffee trees. In the event of a frost, cultivators not only stood to lose their harvests, but also the money plus interest it had cost them to purchase fertilizer [9]. And to make matters worse, fertilizer, once applied, will not benefit subsequent harvests, so that, when a frost occurs, the farmer’s investment is a total loss (Margolis, 1972). As a result of these considerations, many cultivators did not employ fertilizer to keep yields high, yet, without it, the coffee harvests produced in Ouro Verde’s mixed sandy soils, inevitably declined.

“WHERE CATTLE ENTER, MEN EXIT”

The conversion to a cattle economy and the increased size of landholdings have had major repercussions in many spheres: population size and density, class structure, social mobility, employment opportunities, agricultural labor arrangements, and the general economic well being and ambiance of the community all have been affected.

For more than a decade after its founding, Ouro Verde, like much of northern Paraná, was one of the few regions in Brazil in which small landholdings predominated. In 1966, even after land consolidation was well underway, close to 60 percent of the county’s agricultural establishments were less than 60 acres, while only 19 percent could be classified as extensive – 180 acres or more. By 1971, the small farm of 10 or 20 acres virtually had disappeared in the low-lying, more frost prone sections of the county, and it was becoming increasingly rare in other areas as well.

Small-scale coffee growers lacked the land and capital necessary to convert their establishments into viable ranches. It was those with large holdings, consisting for the most part of 10 and 20 acre plots, who were mainly responsible for the tremendous growth of the cattle industry in Ouro Verde. Very rapidly, then, cattle ranching became synonymous with landed property. The social and demographic consequences of these developments for Ouro Verde were critical.

The exodus of small farmers and other agricultural workers from the county after the 1969 frost followed the pattern typical of post-frost emigration, spurred on by the attendant conversion of coffee lands to pasture. Laborers were dismissed *en masse* when the frost stricken landowners could not pay their wages. Large trucks with dozens of people aboard left Ouro Verde for Paraguay and other points west. They carried wage laborers seeking work, sharecroppers in search of productive coffee trees to cultivate, and small holders hoping to buy inexpensive land at the edge of the frontier. Still others headed for the cities of Paraná and São Paulo seeking jobs.

Ouro Verde’s population subsequently declined by over 2300, or some 22 percent, between 1967 and 1970. The loss was not uniform throughout the county, however, and, once again, it was the lowest lying sections most affected by frost that suffered the greatest population decline. As we shall see,

a similar exodus followed the 1975 frost.

Additional land consolidation and the departure of small holders and sharecroppers has depleted the socially mobile “middle level” component of the community. In the process, Ouro Verde’s social structure is growing more inflexible. For the first two decades of the county’s existence, farmers with small holdings and prosperous sharecroppers served as “buffers” between the mass of landless laborers and the few wealthy landowners who resided in the community. Since the mid-1960’s, however, this middle group has declined, both numerically and in percentage of the total population. By the beginning of the 1970’s extensive landholdings had become the norm rather than the exception, with a concomitant increase in the number of individuals owning large tracts of land. At the same time Ouro Verde’s landless segment – principally day and hourly wage laborers – although no greater in number than a decade earlier, had come to make up a large percentage of the county’s population. As a result of these changes, Ouro Verde’s class structure has taken on a pyramidal configuration with a few wealthy landowners at the apex and a mass of landless agricultural workers at the base.

One aspect of Ouro Verde’s increasingly ossified class structure – the reduced opportunities for social mobility – is directly linked to coffee’s decline and the subsequent planting of pasture. During the first years of the county’s settlement, sharecropping high yield coffee trees was nearly a guaranteed path to landownership. Abundant harvests and high crop prices enabled many sharecroppers to make down payments on small farms in frontier areas just opening up for occupation. But the opportunities for upward mobility through sharecropping have decreased steadily since the early 1960’s. Probably the most important factor has been the continual reduction in the number of sharecropping positions available, a result of

the widespread displacement of coffee lands by pasture. Throughout the 1960’s potentially lucrative sharecropping positions were in ever shorter supply and there was a great deal of competition for those that remained. The decline in sharecropping was particularly precipitous following the 1969 frost. By 1970, some 60 percent of the coffee sharecroppers living in the county only three years earlier had moved away.

Then too, frost damage and soil depletion have diminished prospects for social mobility. While sharecroppers were entitled to the same percentage of the crop – owing to smaller harvests – they actually received fewer sacks of coffee in return for their labor than they had a decade earlier. Finally, their financial return was reduced simply because the price received for coffee was considerably lower than it was during the crop’s heyday in the 1950’s. One local informant estimated that, given these conditions, a coffee sharecropper would need a minimum of ten years to save enough money to buy a small farm on the frontier, and this, of course, barring frosts. One can say with certitude, then, that the traditional route to landownership through sharecropping coffee had ceased to exist in the community.

Aside from the decline in sharecropping, other agricultural labor systems have been greatly modified by the transformation of Ouro Verde’s economy. For instance, labor arrangements associated with coffee cultivation – sharecropping, day and piecework, and work gangs during harvests – have declined in importance. By the same token, those geared to cattle ranching – *mensal* labor and *bóia fria*, [10] have become increasingly common. *Mensal* labor and *bóia fria*, for example, are the only systems used on cattle ranches [11]. All cowhands and ranch administrators receive a fixed monthly wage. However, those working under the *bóia fria* system, which first appeared in 1970, are hired for short-term labor intensive tasks such as planting pasture

or building fences. Those employed as *bóia fria* usually work on a holding for only a few days and are then hired by another landowner who is short of hands. Parenthetically, under this system landowners can readily avoid paying workers the minimum wage and can circumvent labor laws in general; this was not so easily accomplished under the coffee regime since labor legislation pertaining to sharecroppers and other permanently resident laborers was more strictly enforced.

Rising unemployment rates have also accompanied the change-over from coffee cultivation to cattle ranching. As a local saying goes, "where cattle enter, men exit" (*onde o boi entra, o homem sai*), since ranching requires far fewer hands than does coffee cultivation. In the words of one informant:

The coffee lands once tilled by men are now occupied by cattle. *Fazendas* (large landholdings) that had 200 families now have five. This was our ruin. The unemployed have no future. They don't know where to go next.

Precise unemployment figures are difficult to obtain since many of the unemployed do not stay in Ouro Verde very long. They move on to look for work in other areas of Paraná, and recently, in the Amazon region [12]. As we have seen, there was a massive discharge of sharecroppers following the 1969 frost, and they, as well as day laborers formerly employed on holdings devoted to coffee, left the county in droves. The reasons for the exodus are apparent: absence of local employment following the frost and the resultant 1970 crop failure. It was not until 1971, when the first coffee beans in two years were harvested, that the employment picture improved somewhat. Once again, I have little data on unemployment following the even more disastrous "black frost" of 1975. But there is every reason to believe that its outcome was the same; large scale dismissals, widespread unemployment, and flight from the county.

It goes without saying that unemployment and the resulting decline in Ouro Verde's population have had a great impact on local, non-agricultural enterprises in the county seat. Since coffee was the primary source of wealth in the community during the first two decades of its existence, the town's economy was profoundly affected by frosts, declining yields, and lower coffee prices. When coffee was king, local stores did a bustling business particularly from June through August when the coffee harvest was underway. By the late 1960's coffee's decline had taken its toll on the town's economy. By the end of the decade, two of the town's general stores had closed for lack of business, and another, which stocked such luxury items as canned goods and wine, also felt the squeeze since these items were in demand only when the coffee harvest was abundant, and brought an infusion of money into the economy.

Local businesses suffered a particularly severe blow after the 1969 frost. Most of the owners of the small stores in town agreed that sales fell off drastically following the frost and remained poor during the spring and summer of 1970 because of the destruction of that year's coffee crop. All businesses, however, were not equally affected. Food stores were not as hard hit since, as one proprietor put it: "People still have to eat". Sales in variety and fabric stores, on the other hand, were off by 50 percent during the months after the frost, clearly because their wares were deemed superfluous luxuries at a time of economic belt tightening.

But no proprietors in Ouro Verde have been as hurt by the shift from coffee to cattle as were the owners of the general stores in the rural area of the county. In one hamlet only four of the ten original general stores remain open: the others went out of business following the frosts of 1963 and 1969 and the subsequent planting of pasture. In the lowest lying portion of the county, a shopkeeper, who had been in business there since

the region first opened for settlement in 1952, marked 1963 as the beginning of the downward economic spiral; sales were off, he estimated, by 60 percent from what they had been in the 1950's when the entire region was devoted to coffee cultivation. He expressed little hope that things would improve.

Finally, it is worth considering local residents' perception of the rapid social and economic change which their community is undergoing. Most view the events of the last ten years with alarm. Indeed, a decided air of pessimism had overtaken the county by the time of my first field work there in 1967. The owner of a small hotel in town summarized the feelings of many:

There was so much *movimento* here when we first came in 1954; so much coffee, so much activity... Now that is all in the past because of cattle. This place won't progress anymore.

A local agronomist rued the fact that the community's schools and health services were being wasted because of the loss of population: "Socially speaking, the depopulation of the rural zone because of the introduction of cattle is a horrible thing". Another resident pointed to the Vagalume section of the county, a low lying area in which frost damage had been most extensive and the transition to cattle ranching was nearly complete. The conditions there, he said, foreshadowed what was to come in the rest of the county: "... houses abandoned, few people, no *movimento*. Within five years 90 percent of the county will be like this. This is our only possible future."

From everything I have been able to learn about the infamous "*geada negra*" of 1975, this man's prediction has been borne out. Although I have little data on the frost's consequences for Ouro Verde itself, reports of its affects on other communities in the coffee zone of northern Paraná indicate the devastation that it wrought.

THE 1975 FROST AND ITS AFTERMATH

What Brazilian coffee growers have come to call the "worst frost of the century" began on the night of July 16, 1975 when an unusually cold air mass moved northward from Antarctica and swept the entire coffee zone of southern Brazil. Although the frost damaged trees in São Paulo, the damage was greatest in Paraná because of its more southerly location. As a result of this intense frost, millions of coffee trees were shattered by ice, and millions more were completely defoliated.

The Brazilian Coffee Institute estimated the pre-frost harvest of 23 million bags of coffee was cut by 70 to 80 percent and that a mere 5 to 6.5 million bags would be harvested following the frost. Within two days after news of the frost reached Wall Street, the wholesale price of a pound of coffee jumped from 27 to 84 cents (AP Report *Gainesville Sun*, February 16, 1977). The result of these events is well known: widespread publicity about the skyrocketing costs of coffee for the consumer and organized boycotts against the drink.

But what happened in the coffee region of Paraná itself where the primary devastation occurred? In the June, 1976 issue of *Veja*, a popular Brazilian magazine, an article entitled "The End of Eldorado?" looked at the impact of the frost on some small communities in northern Paraná, and also briefly mentioned Ouro Verde. In Amaporã, a county about 62 kilometers WSW of Ouro Verde, population declined by nearly 17 percent in the year following the 1975 frost. "And if one were to count again, there would be still fewer people here", a functionary in Amaporã's town hall, was reported to have said. "There are coffee plantations here which employed one hundred families [before the frost]. But the trees were cut down and replaced with cattle. Now there is enough work only for a half dozen", he explained. An ex-major of the county

continued, "After the great frost of last year, there was a general flight to western Paraná and southern Minas Gerais."

In Tamboara, a coffee growing county about 42 kilometers southwest of Ouro Verde, the story was the same. The article describes the local ambiance:

On the main plaza a majestic masonry church with showy stained glass windows is a reminder of the impetus that coffee sales gave to business and church funding raising activities. Now, with 2,000 fewer inhabitants than in 1970, and without the vast plantations of old, the effects of this emigration are evident every morning in Tamboara's main plaza. There, instead of two or three dozen trucks arriving to take the *bóia fria* to the coffee groves, there are only two or three [my translation].

The decimation of coffee cultivation is seen by local residents as the cause of their problems. Schools also have been hard hit by the exodus. In 1970 the one room schoolhouse was too small for its seventy pupils, but the year following the frost, only seven children remained and the school was closed. Today, it is not uncommon to see cattle grazing on what was once the school's recreation yard.

In Paranacity, a county only three kilometers north of Ouro Verde, population also has fallen by nearly 2000 since 1970. Its mayor has attempted to stem the exodus of farmers with small acreages by selling them coffee seedlings well below the going market price. He hopes that his community will avoid the fate of nearby Paranapoema, where hundreds of small landholdings have been consolidated into sixteen huge cattle ranches, and land prices have tripled as the demand for pasture has grown.

But what of Ouro Verde? The article contains little information on the county, but does mention that its population has declined by some 2300 since 1970, a decrease of over 28 percent. A local resident who is in charge of voter registration had no doubt about the cause of the flight. He cited thirty families who left the county after the 1975 frost:

"After their coffee trees were destroyed they lost interest in agriculture". He also pointed out the general malaise in the community as evidenced by the refusal of many farmers to register to vote in the municipal elections. As one explained: "Sooner or later, we are going to have to leave here."

But word of the "end of Eldorado" has been slow in filtering back to Brazil's northeast, once the source of most of the seasonal labor employed in coffee cultivation. One migrant from the interior of Pernambuco made the four day trip to Paraná by bus and truck. Upon arriving in Paranapoema he discovered that there was no work to be had, but before he continued his journey west in search of employment, he commented on the present situation in northern Paraná.

"There in the northeast everything is arid and provides nothing for anyone. But here on this verdant land, only cattle profit".

CONCLUSIONS

Frosts and their impact on human populations are rarely mentioned in the disaster literature [13]. Unlike earthquakes, tornados, and hurricanes, frosts and freezing temperatures do not present any clear threat to life and limb, and, as such, they are said to have a *low catastrophe potential* (White and Haas, 1975:71). Then too, even frost damage to property usually is not immediate. The full impact of the July 1975 frost, for example, was not felt for almost eleven months when the harvest of the badly "burned" coffee trees was due to begin. This is not to imply that frosts have no immediate effect; certainly banks would not loan money to farmers who wanted to use their ravaged coffee trees and their subsequent harvest as collateral. And, as we have seen, frosts can rapidly and dramatically increase wholesale commodity prices.

Despite frosts' low catastrophe potential,

their economic consequences for impacted communities, as well as for national economies should not be underestimated. The United States Office of Emergency Preparedness, for example, estimates that average losses attributed to frosts and freezing temperature run to some \$ 1.1 billion annually in this country alone (White and Haas, 1975:305). But the economic outcome of frosts is not always adverse, at least not on the national level. Thus, despite the loss of some 70 percent of Brazil's coffee crop after the 1975 frost, greatly increased coffee prices on the world market, the sale of coffee reserves, and higher export taxes [14], more than offset the decline in production. In 1976, Brazil earned \$ 2.3 billion from coffee sales, about two and a half times more than in 1975 (AP Report, *Gainesville Sun*, February 17, 1977).

While the Brazilian national economy may have benefited from this latest episode of freezing temperatures by increasing its foreign earnings and reducing its balance of payments deficit, it is abundantly clear that Ouro Verde and other communities like it were adversely, even tragically, affected. In county after county, where dense populations were once supported in at least modest style under a coffee growing regime, there are now abandoned schools and houses, shuttered stores, vast stretches of land with few human inhabitants, and the sort of malaise that comes with the awareness that a region's heyday has passed.

It is very important to emphasize, however, that it is not frosts alone which have been responsible for the decline of coffee cultivation in northern Paraná. Reduced yields due to soil depletion and the failure to use fertilizer, as well as falling coffee prices and higher cultivation expenses also have played a major role in lowering profits and spurring the shift to cattle ranching. Yet, it is worth asking whether the situation would have been different had there been no frost hazard in the

region. Would farmers have been more willing to apply fertilizer to their coffee trees – thus insuring continued high yields – if frosts and freezing temperatures had not been a threat? If conditions of uncertainty had been reduced by the absence of frosts, would cultivators have been less apt to sell their land to ranchers and head for the frontier to seek their fortune? While this may be idle speculation which borders on climatic determinism, it is probably safe to conclude that the recent history of Paraná would have been quite different if frost, the bane of “green gold,” had not existed.

NOTES

- 1 Ouro Verde (“Green Gold”) is a pseudonym for a real community in northern Paraná, Brazil. “Green Gold” is a euphemism for coffee during periods of high prices.
- 2 The Portuguese verb “*queimar*” (“to burn”) is used to describe frost damage to coffee trees. Frost turns the leaves black, giving them the appearance of having been burned.
- 3 See Stanley Stein's *Vassouras: A Brazilian Coffee County 1850–1900* for a discussion of the causes and consequences of coffee's decline in the Paraíba Valley.
- 4 Each sack contains 60 kilograms of coffee.
- 5 We find a similar phenomenon in the United States. In Utah's Wasatch Range, cherry orchards have become increasingly common despite the frost hazard to the fruit. According to Jackson (1974), this is because their return per acre in good years is higher than that of any other tree crop.
- 6 Coffee is by no means the only crop that has spread beyond its climatological limits. In the last century, spurred on by high prices, orange cultivation spread to northern Florida. A series of killing frosts in the 1890's devastated the citrus industry there, and citrus culture gave way to cattle ranching in less than a decade (see Divine, 1942).
- 7 All quotes by Ouro Verde residents are from Margolis (1973).
- 8 Coffee trees do not begin to bear fruit until the fourth year after planting, and it is not until the fifth year after planting that full yields are produced.
- 9 About 70 percent of the landowners and sharecroppers in Ouro Verde borrow money annually from banks or middlemen to finance their cultivation expenses.
- 10 *Mensal* laborers receive a fixed monthly salary. *Bóia fria* are labor gangs hired to perform a specific task. They are paid daily or on piecework basis. *Bóia fria* is slang for “cold lunch”. These gangs are called by this term because the workers who form them bring their lunch with them

in the morning, and by the time they eat it in the fields at noon, it is cold.

- 11 By 1971 *bóia fria* also were employed on the few large holdings still planted in coffee. The work gangs were employed for pruning and harvesting the trees, and for other labor intensive tasks.
- 12 According to Moran (1975 and personal communication) a fairly large number of settlers in Altamira, a town on the Transamazon Highway, came from the coffee region of Paraná.
- 13 The only studies of frost and its impact on human populations of which I am aware are Margolis, 1973; Jackson, 1974; Ward, 1974 and Waddell, 1975 and 1977.
- 14 At the time of the 1975 frost Brazil had a stockpile of about 25 million bags of coffee to draw on during the three or four years it would take for newly planted coffee saplings to bear their first fruit. In addition, Brazil raised the export tax on a 132 pound bag of coffee from \$ 21 before the frost to \$ 100 by early 1977 (AP Report, *Gainesville Sun*, February 16, 1977).

REFERENCES

- Divine, R.A. (1952). *The History of Citrus Culture in Florida, 1565–1895*. Unpublished manuscript. Gainesville: P.K. Yonge Library of Florida History.
- Jackson, Richard H. (1974). "Frost hazard to tree crops in the Wasatch Range: perception and adjustments," in Gilbert F. White (ed.), *Natural Hazards, Local National, Global*. New York: Oxford University Press.
- Margolis, Maxine (1972). "The coffee cycle on the Paraná frontier," *Luso-Brazilian Review* 9(1): 3–12.
- Margolis, Maxine (1973). *The Moving Frontier: Social and Economic Change in a Southern Brazilian Community*. Gainesville; University of Florida Press.
- Margolis, Maxine (1977). "Historical perspectives on frontier agriculture as an adaptive strategy," *American Ethnologist* 4(1): 42–64.
- Monbeig, Pierre (1952). *Pionniers et Planteurs de Saõ Paulo*. Paris: Librairie Armand Colin.
- Moran, Emilio (1975). *Pioneer Farmers of the Transamazon Highway: Adaptation and Agricultural Production in the Lowland Tropics*, Ph.D. dissertation, University of Florida.
- Stein, Stanley (1975). *Vassouras: A Brazilian Coffee County, 1850–1900*. Cambridge: Harvard University Press.
- Waddell, Eric (1975). "How the Enga cope with frost: responses to climatic perturbations in the central highlands of New Guinea," *Human Ecology* 3(4): 249–273.
- Waddell, Eric (1977). "Coping with frosts, governments, and disaster experts: some reflections based on a New Guinea experience and a perusal of the literature". Paper presented at the 76th annual meeting of the American Anthropological Association, Houston.
- Ward, Robert M. (1974). "Decisions by Florida citrus growers and adjustments to freeze hazards," in Gilbert F. White (ed.), *Natural Hazards, Local, National Global*. New York: Oxford University Press, pp. 137–145.
- White, Gilbert F. and Haas, J. Eugene (1975). *Assessment of Research of Natural Hazards*. Cambridge: MIT Press.