The man in struggle against its own nature: Knowledge battles among the peasants and the scientists

Myriam Paredes[1] and Stephen Sherwood[2]

First draft (26/June/03)

Our knowledge and organization, that is, our ability to act effectively in the dominations of our existence, is limited since our current theories of the science are concerned about the past challenges: lack of control over nature (science) and scarcity (economy). Nowadays we face another problem: the ecosystem crisis. The context has changed and the survival depends on the ability to change our paradigm toward one that makes it possible for the humankind to be liberated of the crisis that has created for itself.

Before seeking alternatives, first we should think on how the present managed to be non-sustainable. For this purpose, we take as an example the experience lived in the Province of Carchi.

Soil management and pests in Carchi: Social breaking of an ecosystem crisis

Some three years ago here we *did not apply pesticides but a man who lived near the community began to apply them. It seems that the worms came in the products, because after that the pests have increased. Now it is no longer possible to produce without applying chemicals.*
--a farmer of Carchi

Studies recently published in Ecuador by the National Institute Autonomous of Livestock Research and the International Potato Center show a human and ecological crisis without precedent in the Province of Carchi. The majority of farmers in Carchi are of small and medium scale and use pesticides intensively. From its introduction in the 1960s, the indiscriminate use of agricultural chemicals, especially of highly toxic compounds, has turned on systematic, which has caused damages to humans and to the natural pest control mechanisms. This phenomenon has helped to strengthen a vicious dependency circle in the agricultural chemicals, whose use tends to increase gradually. The medical studies have shown that more than 60% of the rural population in Carchi is affected at a neurological level due to its exposure to the pesticides and that this condition interferes significantly with its managerial capacity as producers. This level of affectation by exposure to pesticides is between the highest reported at world level.

It seems that today we cannot live without, nor with the pesticides. After more than 2,000 years to be producing potatoes in Ecuador without the assistance of the agricultural chemicals, how is that we arrive to is it situation in less than 50 years?

Socioeconomic explanations

Given the present agricultural intensification in Ecuador, the production of various crops has increased thanks to the application of technologies that require the intensive use of chemicals. While a greater integration of the market has contributed to the reduction of the biodiversity of germplasm and the mechanized cultivation, it has caused erosion and compaction of the soil. As a consequence of the risks of the market the farmers have experienced considerable economic loss due to the fluctuation of prices. The irresponsible dissemination of the modern technologies like the pesticides has had a negative impact both in the ecosystems and in the health of the agricultural communities, which recently has resulted in an increase of the uncertainty in the production and an increase of the health risks.

It is estimated that from the agronomic perspective the farmers of Carchi over-apply the fertilizers and pesticides by a factor of two. To the naked eye, the reduction in the exposure to the pesticides can

[1] Consultant in Rural Sociology, Quito, Ecuador, e-mail: myriamparedes@mac.com
[2] Representative of the Andean Area, Worldwide Neighboring, Quito, Ecuador, e-mail: sherwood@uio.satnet.net

look like a very simple action, for example, to inform the agricultural communities of the risks in health that implies its use, to promote the use of personal protection equipment and to introduce alternative technologies. Nevertheless, studies in several countries, including Ecuador, show that the interventions oriented toward the safe use of pesticides have not had a significant impact on small farmer populations. From the social and economic perspectives the reduction of the exposure to the pesticides represents a challenge socially complex and a great political challenge.

According to the farmers of Carchi, the chemical products represent safety before the immediate risks associated with the epidemics of pests and diseases, that continually threaten the crops. The farmers usually consider the pesticides as an essential element for its survival. This association is related to a high degree of dependency and faith in these products. Add to this the presence of a great market of agricultural chemicals (in Carchi estimated in nearly $5 million per year).

Communities that traditionally have depended on monocultures destinated to the sale with high use of external raw material tend to define their social status in accordance with the level of use of external raw material. Studies in Carchi found that the producers most admired in the community were the ones that utilized more agricultural chemicals, made high capital investments, and contracted paid labor (Paredes, 2001). In the other extreme, the producers who used low levels of agricultural chemicals and capital, and basically worked with family labor or exchange labor were considered poor or little efficient. The risk taking in the pesticide application also was a social gender marker. For example, the farmers most risky in the use of agricultural chemicals without protection were considered stronger or of more manliness. The women, the children, the least risky farmers, and the day workers who suffered immediate effects in their health (by the contact with the pesticides) were usually considered part of a weaker group, of less manliness or feminine.

The risk taking in the production was also related to the expectations that the farmers had for their families. The most risky farmers hoped to educate her children so that they had to not live in the field. For them, the taking of risks represented a price to pay. The least risky farmers, on the other hand, pursued to develop their farms and saw in their children the future of the farm. The family labor was part of the training and capitalization of experiences. Many of the times these farmers considered that the higher education put at a distance the young people of the needs of the field and not always offered guarantees of employment in the city. Consequently, the risk taking was a threat for the consolidation of their farms.

Such perceptions on the risk turned out not to be necessarily related to the economic status of the families. Several of the risky farmers had debts with banks or cooperatives and had lost their lands, or subsidized the potato production with the livestock production. While in the other extreme, little risky farmers sometimes had more lands that the risky, little or no debt with the banks or cooperatives and low capital expenditure in labor, but not necessarily less use of labor.

Knowledge sociology

The scientists from their various perspectives define the problem of the exposure to pesticides as a matter of lack of knowledge of the farmers on the pesticides. Consequently they suggest interventions aimed to "educating" or "improving" the knowledge of the farmers (for example, education in the safe use of pesticides or the sale of protection equipment). The peasants of Carchi define the problem of the exposure to pesticides as a dependency due to the needs of survival. The vision of the farmers suggests political decisions, for example, the creation of more just markets, the suppression of highly toxic pesticides and its replacement by other alternatives.

On the other hand, the scientists enjoy a legitimacy of its knowledge as universally valid (for example, the chemical compounds are universally recognized), it has been said that science is knowledge, suggesting that there do not exist other forms of knowledge that is not the one generated in laboratories and in controlled and numerically measurable situations. Any person or group that handles the scientific knowledge referring to the pesticides has "authority", is taken seriously, and can influence other groups with power, as the donors or the politicians. The local knowledge of the farmers (in this case the production of potatoes with high use of pesticides) is conventionally classified as "ignorance", and does not have universal recognition but instead local recognition. For example, few

scientists handle the knowledge necessary to produce potatoes under the conditions of Carchi. In order to do it they would have to "know" how all the aspects of the production in the locality function, both in what is technical and in the social, so that they would have to interact and continually learn from its neighboring farmers. However, the knowledge of the farmers, upon not being universally valid or generally applicable, is of little interest for politicians or donors. In this way many interventions have been based on the assumptions of the scientists and have been unaware of the local strategies as a way of knowledge and survival.

This reflection makes it possible for us to prepare one of the ways in which the sociologists define knowledge. Sociology focused on the actors considers that any person is capable of thinking about its own experiences and generating valid knowledge, that makes it possible for him to act and survive within his/her community (the family, the region or the country). As a result there are not more valid knowledges that others, but valid knowledge in its context (that of the scientist, of the farmer and politician). This suggests that, under this standpoint, the *knowledge* is generated and transformed not as something abstract but with regard to the contingencies and daily challenges that constitute the life of the individuals.

In a didactic effort we would say that the scientists, the politicians, the farmers, etc. have different works and live in different realities. Despite all they need to generate knowledge that makes it possible for them to survive effectively in the society and in their environment. Surviving in society means then not only developing strategies to fill basic biological needs, but also defined needs according to the standards and the values of each society in which we live (for example, how to be respected and that means to be successful). This in turn implies a form to "know" and interact with the environment that surrounds us. That is, if the form to survive is to generate knowledge in accordance with the values of the society in which we live (scientific, rural, political, etc.), we can say that the knowledge is socially constructed.

Perhaps there have existed moments in history in which different human groups were more or less isolated. The survival then depended, among other things, on the interactions within the same group--the knowledge was generated within the group. For several reasons the interactions between individuals and above all between different social groups has increased and has become a need. As in case of Carchi, individuals, and groups that come from different contexts, they continually interact, they do it from their vision of the world. In the interaction with individuals or groups that have different values and needs, new knowledge is constructed by all the actors. The different visions to which is exposed every actor are not simply added but instead negotiated, rejected or adapted.

Accordingly, sociologically speaking, it is not possible to transfer knowledge (or technologies), since no individual (scientist or farmer) is empty of knowledge. Moreover, no individual is free from his values and his own opinion on what is convenient for him or on what considers that is "better" (for his survival in community and for the environment). Upon putting the knowledge of the farmers in the same level that that of the scientists or any other professional, there is more visible the analysis of the power that each one has within the society. That is, all of them have valid knowledge (otherwise they could not survive), but some exert more power in order to intervene in life of other groups.

This form of seeing *knowledge* opens to us spaces in which, upon speaking about interventions, the most equitable interaction (with respect to the power they have and the legitimacy that they have) between farmers and scientists is made focus for the production of more "human" solutions that allow room for different realities and forms of knowledge.

The knowledge of the farmers from the perspective of the scientists

The scientists have identified a phenomenon of gaps in ecological knowledge for the management of modern technologies on the part of the farmers. It has been concluded that such gaps limit the capacity of the farmers to respond effectively to new problems of field. This limitation represents a considerable obstacle regarding the proposal to achieve more environmentally appropriate systems of production under the current conditions of technology development and the challenges of the economic system.

It is important to recall that the farmers did not develop knowledge in these areas precisely because it was not previously necessary for their survival. For example, due to their systems of rotation and practices of multi-crop, it was not necessary to know so many details on pests. Nevertheless, changing conditions now demand both new knowledge, and an unprecedented learning rate.

Studies have argued that the knowledge in the rural communities on agro-ecological processes vary tremendously (Sherwood, 1997; Sherwood and Bentley, 1995; Bentley, 1989; 1991; Huapaya et al., 1982). They explain that these lacks of knowledge are due to social and ecological factors, and limit the capacity of the farmers to respond efficiently and effectively to new problems in the field. For example, it has been determined that the rural knowledge of the pests and diseases is governed by two independent variables: facility of observation and perceived importance (Figures 1 and 2). As an example, the cultures are easy to observe and are important for the farmers. Accordingly, the people who live in rural areas tend to develop in-depth knowledge of the stages of growth of the plants (Bentley, 1989). While, they do not know of the pathogens, which are usually microscopic and, from this perspective, little important (Sherwood, 1997). The observation facility and perceived importance can be used to explain the rural knowledge. It has been concluded that the farmers of Latin America understand more on plants, that are usually macroscopic and stationary, less on insects that are small and mobile and still less on the organisms which cause diseases that are essentially invisible.

While the farmers know relatively a great deal on insect pests, commonly they do not know key concepts on the reproduction and metamorphosis of insects, as much as relationships between pests and depredators. They are commonly competent in explaining the abiotic diseases, as effects of the drought or burns by the agricultural chemicals. The farmers are fewer competent in explaining biotic diseases, that in rural taxonomy are usually organized in two broad categories: yellow boat and black boat, terms that refer to the symptoms of the leaves. Due to the invisibility of the interactions between hosts and pathogens and limited access to the scientific information in the rural areas, the farmers of the Andes usually do not know the pathogenic causes of the biotic diseases. Although the studies demonstrate an extensive knowledge of the environmental conditions associated with the diseases.

As a result, the farmers of Latin America have created explanations named "folkloric" on the plant health problems. For example, they commonly reflect to fluctuations in temperature, astrological activity, behavior of animals, or mystic energies as causes of the plant diseases. In recent decades, the epidemics are increasingly common due partly to the intensification of the agriculture and to the use of agricultural chemicals. Accordingly, there exists the belief that the agricultural chemical sellers put pests in their products.

On the other hand, in the best of the circumstances, the technicians can identify the disease names, but usually, they only provide information on the chemical control. The technicians rarely understand or try to explain the cycles of pests or diseases to the farmers, the cognitive key to be able to explain the mystery of these phenomena. Without clear knowledge of the causes of their problems, the practices of the farmers end up being useful, non-useful or, in some cases, harmful.

	(low) Importance (high)
• lonely wasps • scissors (tijeretas) • spiders • depredation of insects	• social wasps • bees • weeds • tools • Phenologycal periods of plants
• parasitic wasps • pathogens	• plant diseases • reproduction of lepidopterous

Fig Four classes of knowledge of the farmers (adapted of Bentley, 1991)

	(low) Importance (high)
• many categories • little taxonomy • organisms named up to order or family • little explanation	• many categories • complex taxonomy • organisms naned up to the level of species • positivist explanations
• there are no categories • there are no taxonomies • organisms not named • without explanations	• few to many categories • various taxonomies • organisms with and without names at the level of species. • quaint explanations

Fig Classification of the classes of knowledge of the farmers (adapted of Bentley, 1991 and She l, 1997).

How is it that we arrive to this reality? Without a doubt, it was not the intention of the farmers, of the scientists, nor politicians 50 years ago, when the technologies of the green revolution began to enter in the region.

The social knowledge of the scientists from the anthropological perspective

In principle, the scientists have seen their role as the only knowledge generators. Accordingly, the interventions directed by the governments or by private entities have attempted to transform the society in accordance with their particular perspective and in accordance with their interests. In order to assess their populations target, they usually have followed their own criteria of poverty and ignorance. In this regard, the science represents a subtle form of social domination.

In Ecuador, the conditions of the agricultural rural zones continue to be unequal. Perhaps a form to explain the results is, on one hand, the non-controllable nature of the technologies created by the "experts" and, in addition, the little knowledge that the scientists have of the rural realities. Both aspects have interacted and have been mutually strengthened.

The so-called green revolution presumed that the technologies could be transferred in order to develop the poor social sectors. In this regard, technologies like the pesticides and improved seeds were perceived as the solutions to poverty and inequity. Such hopes proved not to be real and in some cases increased the gap between the poor and the rich. For example, new varieties only were more productive in the better land, property of the richest individuals of the communities. Or as in case of Carchi, technologies as the pesticides have proven to have unwanted consequences in the health of the rural population.

Subsequently, new theories of extension have advanced toward concepts of "translation", which presumes that the knowledge of the "experts" first has to be "translated" or explained in different form, so that the groups to which it is directed find it usefully and subsequently apply it. This model neither has proven to be very effective. For example, the development of new forms of communication and interactive methodologies has succeeded in obtaining that the farmers understand new forms to understand biology and ecology; however, this understanding not necessarily has helped them to solve their problems. The majority of farmers in Carchi have been trained on the effects of the pesticides on the health. Nevertheless, that has not meant a reduction in the use of them or in the use of clothes of protection for a large population.

The current situation demonstrates that the interventions have not permitted to consider people as passive or beneficiary receptors. Seldom the efforts to understand the problems from the standpoint of the "affected" have gone beyond the participatory diagnoses (easily manipulables) or of the surveys. The perception of the community as a homogeneous group in terms of knowledge and power, or even more, the romantic ideas of the communities as harmonious groups, capable of responding to any change in controlled ways, are part of the limitations and risks that the "experts" face upon making interventions.

The persistence of the ideas of superiority of the knowledge of the "experts" throughout all the process of intervention has only achieved a growth of the ignorance that we have on the communities and it underestimates it to its survival strategies. It seems that our romanticism on the technologies has consolidated and maintained the historical conditions of inequality of the society. At the same time the knowledge of the "experts" has not always achieved the desired results.

We need to go beyond the "dialogue of knowledge", toward the inclusion of new assumptions:

- ☐ The farmers and rural populations, in order to make their decisions, not always need the information that according to the "experts" they would need to know. The markets, the policies, and the natural phenomena are not rational. How would the farmers survive before there is so much "expert" information?
- ☐ Perhaps there are cases in which what we know the experts is not what is needed in order to achieve the social change that the communities desire.
- ☐ The social dynamics vary within the groups. We can understand them better but we not necessarily can control them in the future.

- ☐ Perhaps the local actors from our perspective "have not changed" because" they do not consider that it is necessary, possible, or sustainable to change in the directions that the "experts" consider necessary.
- ☐ After all, the "experts" can be completely ignorant of the local situation. Perhaps we have not learned to be patient and to listen first how the local actors do.

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FOOTNOTES/ENDNOTES

1. Consultant in Rural Sociology, Quito, Ecuador, e-mail: myriamparedes@mac.com
2. Representative of the Andean Area, Neighboring World, Quito, Ecuador, e-mail: sherwood@uio.satnet.net