Qu’est-ce que l’agroécologie ?

Agroécologie, résilience et souveraineté alimentaire

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Retranscription de la conférence

Miguel is certainly a pioneer of the research in agroecology. He has written a number of influential books on this topic and he’s also the author of close to 200 publications on agroecology. And the science of sustainable agriculture, biodiversity and pest management. So I’m glad to introduce you for this conference. Thank you.

Both my wife Clara Nicole who’s also a researcher at the University of California and myself have had the opportunity to interact with scientists of Inra both in Toulouse and yesterday here in Paris so we are becoming a little bit more familiar with the kind of research that the SAD group is doing on agroecology. The purpose of this lecture is to give you a little flavour of what we understand of agroecology, what are the applications of agroecology. I apologise if there are some slides that have been duplicated.

The first thing that I think motivates agroecology is to understand that today the planet is confronting crisis that are very deep and that we need to solve very quickly. The first one is that we have an economic and financial crisis. I think you’re suffering now in Europe. I think we’ve started in the US about three years ago. There’s an energy crisis and there’s an ecological crisis of which climate change is just one manifestation. We cannot generalise that climate change is just a dominant ecological change. Actually there are many ecological dimensions of this crisis. We need to understand that this crisis is the product of a model, of a development model that has been dominant and that therefore we cannot solve this problem with the same thinking that created it.

Einstein said that you cannot solve the problems with the same mentality that created them. You need a new paradigm, a new approach, a new way of thinking that has to get away from this linear thinking to a more systemic thinking in order to solve these problems. Natural systems are under stress, we have major problems of deforestation, ocean fisheries collapsing, there’s a huge amount of species extinction going on. We’re losing species without knowing their ecological role in the ecosystems. There are several systems that are at risk in terms of pollution, water scarcity and climate change of oceans. Throughout the globe, we see that there are systems in crisis and we need to address this problem from its causes. There’s a group in Stockholm that talks about the planetary frontiers. They are basically trying to tell us that there are certain processes in nature that have gone beyond the thresholds, like biodiversity loss, nitrogen cycle, climate changes, ocean acidification and other problems that perhaps it’s too late to reverse.

Therefore, we need to act urgently at the planetary level to start dealing with these issues. Associated with these environmental issues also are problems of socio-economic nature. Particularly, I think the first three ones that are relevant to agriculture are the problem of pov-
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Property. Three billion people live on less than 2 dollars a day, hunger, inequality which are at the root of the hunger problem in the world. So we could say that as access to petrol and environmental security deteriorates, food scarcity is becoming incredibly threatening, and food availability and agriculture is the weak link between the economic system and the ecosystem. Actually agriculture is at the interface of economic and ecological systems and therefore it’s a weak link. As the economic system deteriorates and the environmental system deteriorates, so does the access to food and the possibility to production. Now, there’s a lot of discussion about why do we have 1 billion people hungry in the world today. There are some proximate causes, it’s to do with some drops in production because of some droughts in Australia, in Argentina and Texas, increased consumption of meat in India, low rain reserves, high cost of petroleum, agro-fuels expansion, all these are important causes but they’re really proximate causes.

Today there is a lot of discussion about whether the control that certain corporations have over the food system has anything to do with food prices and food scarcity. So here we see the seed industry how just a bunch of different companies have started to control this very important part of the food system. Average food prices have been going up and basically triggered what is called the food riot. But interestingly enough the profits of multinationals also went up as food prices went up and there is actually some very interesting research showing that there are some thresholds of food prices in which we can predict when food rise will occur. So the food rises were not due to the fact that there was not food out there. It was due to the prices of food. And it’s very clear that it’s possible that many of these price increases will continue to trigger more food riots in the future.

Despite this, there’s a debate in the agricultural international levels, international agricultural sectors that are discussing what are the best approaches for increasing production for the future. There’s one dominant force which talks about biotechnology and application of biotechnology to develop transgenic crops. Since they’ve been expanding from 1996 to today, 190 million hectares of transgenic crops in the world, dominantly roundup ready soybeans and beet crops, a special corn, and then you have cotton, and canola. One thing that is very important to understand is that out of these 190 million hectares, there’s not one hectare that is feeding one of the one billion people that are hungry today. Because most of this production of corn and soybeans go for biofuels and also for feeding cattle. But cattle meat is not available to the people who make less than one dollar a day which is the 1 billion people that are poor.

Although technology might have a potential to increase production of food, today, it’s not contributing at all to the problem of hunger in the world. This agriculture is also reaching its own limits for example in Argentina it’s a very typical component of what is called a no till or conservation agriculture where you have corn and then you’re able to basically no till the soil and leave the straw and apply the herbicide as many times as you want because the soil is resistant to the herbicide. This is a very common system not only in the States but also in Brasil and Argentina. And you can see that the use of herbicide went up considerably in Argentina as the use of other atrazine and 2,4 D went down. But unfortunately the systems find their own contradictions so one of the biggest problems which was to be expected is the development of
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There are many species of weeds, about 30 of them in Argentina and Brazil which are already resistant to Roundup. They cannot be controlled and perhaps the worst problem is the soybean that comes up here that is called the volunteer soybean because it’s harvested with machinery, the little seeds drop and they come out of place which is the definition of a weed. And they cannot be controlled with the glyphosate and they have to use 2, 4 D.

So this system, this magic bullet approach finds its own contradictions and the same thing happened with pesticides or systems of insects. There are more than 450 species that are resistant to insecticides. There’s also an increasing interest in agricultural land to produce biomass not so much for food but there’s interest in bio plastics, in bio fuels, and there’s a huge convergence of companies, all the way from grain exporters to car companies, petroleum companies.

So you can see the expansion of the production of the main biofuel crops of the world: maize, sugar canne, soybean, palm oil and how in some cases some of the crops that we depend on are basically going down in areas because of this displacement by the biofuels. It is interesting that in the United States, if we were to devote all the corn area, the area of the corn for ethanol production the country would only be able to satisfy one percent of its needs of ethanol so there’s definitely a deficit of land. The country consumes about 48.5% of the world’s energy as opposed to the rest of the world that consumes the rest, the 170 countries that consume the other 50%. There are only about 18 to 20 countries that are consuming most of the energy of the world and these countries desperately need an alternative energy matrix and that’s why they have gone to agrofuels especially in the United States. You can see that the only areas, the last frontiers are two. It’s Africa and it’s America. There are no other areas, it’s called the last agricultural frontiers where they can do the expansion of this. Unfortunately what has been going on is a severe process of land grabbing and there’s a recent report by IFAD the International Fund for Agricultural Development that about 50 to 80 million hectares have already been transacted worldwide to produce these agrofuels especially in countries like Madagascar, Ethiopia, Mali and so on.

So what are the challenges are we facing in the future? We need to increase production obviously. But we have to use the same or less arable land, with less plutonium, less water, less nitrogen. In a scenario of climate change, social regression and financial crisis, the whole importance of agroecology is that this challenge cannot be met with the existing industrial agricultural model and its biotechnological digressions. In other words, we need a new paradigm. This was the conclusion of the report of the IAASTD study which said that this cannot continue, we need to come up with a new approach. The features of the agriculture of the future is that it has to be decoupled from fossil fuel dependence. We have to develop agricultural systems that are of low environmental impact, that are resilient but multifunctional and that provide the foundations of local food systems as opposed to globalised systems.

So among this diversity of systems that we have here, we have agroecosystem diversity, high, low and then productivity low and high. You can see that the agroecological systems are
those that have high productivity, high diversity, high efficiency because they have low dependence on external inputs, high levels of recycling rates, and high levels of integration, of cropping systems and livestock systems and forced systems altogether into very complex farming systems. This is where agroeconomics then comes in as a science. Agroeconomics is not a system of production, it’s not a set of practices it is a science that provides principles on how to design the systems of the future, the systems that are going to be biodiverse, efficient, resilient and so on.

So you can see that we have the contributions of one science that comes out of our universities, out of the ingress and so on but also we have the knowledge of the farmer which is a very important part especially in the third world where farmers have been farming for thousands of years and they have accumulated a knowledge system and management systems that have stood the rest of time. So the combination of these two knowledge or this dialogue of wisdoms leads to principles. And these principles take different technological forms depending on the socio-economic, environmental, cultural conditions of each area and in order for those forms, these technological forms to be relevant to farmers, they need to be emerging from a participatory process in which farmers not only participate in lending the land for the research but participate in setting the research agenda, participating in the research processes and the evaluation of the processes.

One of the focuses of agroeconomics has been small farmers especially in Latin America because small farmers in the world play a key role in feeding us. 50% of the food that we eat today comes from small farms. Only 30% comes from the industrial food chain. The rest comes from fishermen and gatherers and hunters and so on. So there’s a really important realisation of the role of the small farming systems in feeding the world. There are about 1.5 billion peasants many of them deployed in 380 million farms and they produce a lot of the food that we are eating today. On the other hand, small farmers, peasants have actually had a huge contribution to biodiversity. It is estimated that they have come up with more than seven thousand breeds of animals and about 1.9 million varieties of crops that they still preserve or there’s a level of the ocean whereas the green revolution varieties since the 1970’s we were only able to develop 8 thousand varieties. So the contribution of small farmers to agrobiodiversity, the genetic basis of all the sustainable agriculture that we need to develop comes from them.

We have been also very interested in understanding why the small farms seem to be more productive than large ones and there’s some very interesting data that’s showing that if you plot total output, country after country there’s a study that is publishing Foodfirst.org by Peter Rosset using data from Fowl who plotted for 8 countries and he found the same trend, that the total production that is the addition of all the production of small farms is much higher than small scale systems and the large scale systems. Because farmers don’t just produce wheat or corn, they produce beans and squash, chickens and livestock and fruits and all kinds of things so that’s total production. And one other thing that has been done is that there’s been a tremendous amount of research trying to understand the efficiency and the productivity of these poly-cultural systems. There are some books that have been published by Charles Francis, by J. Van der Meer on the ecology of intercropping showing that these systems are able to over yield by
calculating what is called the land equivalent ratio which shows that these systems are much more effective in using the local resources than large scale monocultures.

We have also been doing work to understand why small farming systems are not only resilient and productive but also what are the ecological interactions that go in these systems that explain their sustainability in the long-term. Some studies in Southern China have been done in the rice fish systems showing that fish systems not only play a very important role in aerating the water which will favour the rice crop but also that this fish play a very important role in controlling pests. Because these fish are able to push the rice, shake them, and then these little insects, the leafhoppers, will drop by and they will consume them. But it's not just any fish. There's certain fish that have a particular behaviour that can have that effect. As you can see here the systems with fish have much higher yields than the systems with pesticides. Because the fish are having other synergetic effects on the system that not only reduce the pesticides use but also enhance yields. So we're very interested and our huge field not only has been understanding this traditional millenary systems but also the innovation that farmers are doing constantly. They're experimenting constantly. We were doing some research in Southern Brazil in the State of Parana where farmers use this cover corn mixture. They call it the Cocktail of Cuvertura which is basically a mixture of various cover crop but they're always made of a mixture of these three species: *Secale cereale*, *Vicia sativa* and *Raphanus sativus*. These plants when they grow, they plant them in the fall and then they come in. As you can see they're already growing and producing a lot of biomass, then they come in with a machine call the Rola faca which is like a roller, it could be a tree trunk. Then it smothers the crop and with a very simple tool, with animal traction, they plant their crops over the residue. As you can see here the crops, the corn and the beans came up but not the weeds. There's no emergence of weeds. So this is an organic weed management system and the way it works is that the residues when they start decomposing they start releasing the special *Secale cereale* and the *Raphanus* and a low chemical compounds that actually concentrate in about two centimetres of the soil surface.

This is a toxic zone where 99% of the weed seedbank is and the farmers already knew that by planting the crops deeper by three or four centimeters were able to have a standard crops without any weed emergence. So the ecological understanding of these mechanisms has been a crucial work that we have done in agroecology. Claude is an entomologist; she's been in understanding why when farmers mix crops you don't have pest problems. This is an interesting study that was done in Costa Rica where farmers are exposed to white flies that transmit viruses which are very dangerous, very severe pest, and you can see here that tomatoes are growing without the need to spray pesticides because they're mixed with cilantro (*Coriandrum sativum*). So this is a tomato field but the cilantro plays a very important role in repelling or limiting their colonisation of white flies because of the background, because of odours, because of all kinds of chemical interactions, and visual interactions that we're just starting to understand. So understanding farmers' innovation has been a huge field of research in agroecology. We seem to always be behind farmers. Farmers are innovating much more quickly than us. We're trying to understand what they're doing and then derive the principles so we can spread these principles to
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other farmers. I think that perhaps the most important area of research going on today is the whole area of resilience.

We see climate change, we see disturbances and climatic extremes are becoming more frequent, more severe, and there's some evidence that in international systems we can learn lessons about resilience. For example in China, in the same area where the rice fish systems are, where there was a huge drought, where intensive drought was present, there was no possibility of production. Not too far from there about three kilometres you find these terraces which are not only resilient because of the management and the way the farmers manage their fields but also because they were inserted in a much more complex landscape matrix. You can see that in an area totally deforested, there's intensive rice. This is the area of the traditional terraces surrounded by a matrix of natural vegetation which basically explains a lot of the resiliencies. The resiliencies are not something that happen at farming level but the landscape matrix is very important in determining resilience.

A lot of research has been done on understanding what happens in agroforestry systems when you get rid of shade like in Brazil where there's a big emphasis and in Colombia to try to go to sun loving coffee because it produces more. But when you get rid of those trees not only do you get rid of the ecological services but in the systems, this is the tendency. You lose a lot of biodiversity as you move from one system to another but actually there's a lot more water loss evapotranspiration is much higher in these coffee systems that are monocultures as opposed to the ones that have very complex shade. So yes you can increase production of coffee but what happens when the drought comes? What are going to be the consequences?

In Colombia and Mexico in many parts the scientists has spent a tremendous amount of research and money on improved grasses. And these grasses are productive as long as you have water and nitrogen. What happens when the drought comes, which is what is happening is that you lose like in Colombia 250 000 heads of cattle in just one long drought. In that same area they have agroforestry systems that have been developed by agropastorals systems, and other workers have shown that these systems are much more resilient. You have less losses of water, the animals are still maintained despite that fact there is a pronounced drought. Actually there is an area photograph that I don't have here showing that these systems which are dispersed through the landscapes are the only green spots left in this ocean of dry areas.

So resiliency is the propensity of a system to maintain this organisational structure through two properties. One is the resistance to the shock and the other one is the capacity to recover. The recovery aspect of resiliency is very important. So there have been some studies done for example after Mitch in Central America, that happened in Honduras and Nicaragua shows that the farmers that have had monocultures suffer much more damage like mud slides. Whereas the farms that were near here, they did pair comparisons on about a thousand farms you can see that there's very little mud slides, very little damage because of the soil cover provided by the green manures and by the agro forestry system etc. and you can see that on average at the end of all the study in Honduras where Mitch was much more severe shows that the
diversified farms suffered much less damage than the monoculture farms. There's an element of ecological resistance that is provided by this diversity. In Cuba there were three hurricanes in 2008. One of the biggest ones was Hike and these farms were the ones that suffered less damage. They were the ones that had agroforestry or the ones that had hedgerows or more soil cover and you can see here in a cooperative in Santi Spiritu which is an organically managed cooperative, you can see that 73% was the average of the cooperative but there were a couple of category 2 and 3 more complex farms that suffered less damage. They still suffer, 60%, but than 73% which is the average of the farms. And you can see that the recovery rate, the days after the impact of the storm, 60 days to 120 days the more complex farms recovered faster than their productive capacity. 60 and 120 days and so on. This is just one example of another farm in Cuba after another hurricane called Mitchell where you can see that three years after the farm was able to be in that recovery state, a very quick recovery of the management system.

The last topic that we're very interested in in agroecology is the role of transition because not only small scale farms are the dominant, although they're very important because of the reasons I mentioned before, but there are large scale systems that need to be converted to a more agroecological management. So the whole idea of how do we go from system degrading high input monocultures into sustainable low input highly diversified systems is a key issue. And these systems are not input intensive but they're knowledge intensive. That's where agroecology comes in because it provides the framework to understand the complexity of the systems.

So there's been a lot of work done on what is called the transition all the way from diminishing the inputs with IPM and those kind of practices which diminish the input of chemicals then you have the input substitution phase where you replace those chemicals for biological inputs then the system reassigned which is a system that is able to function and is sponsoring its own soil fertility and pest regulation without external inputs, not even organic inputs. There's about 35 million hectares of organic agricultures certified in the world. I always say that between 60 to 80 percent of this agriculture is managed as input if substitution although some colleagues don't agree with that. What do we call input substitution? Organic farms that basically change one system for another. They go from chemical managed systems to organically managed systems leaving the monocultural system the way it is. So here we have a typical example in California. A farmer brings the compost from the outside of the farm. Then plants a system, which is strawberries, organic monoculture. If you're driving you cannot tell me if this is organic or conventional. There's no structural difference. It's a monocultural system and they spray a lot of products. Some farmers spray up to 20 different products that are organic. Some of these products can actually cause treadmill problems.

For example sulfates in vineyards are very good to control certain diseases but they kill beneficial insects so you get into this treadmill. Botanical insecticides like Rotenone, they're wide spectrum. They're environmentally more sound but they can kill beneficial insects too and create problems. So what we're talking about is the transition from monospecific systems whether they are organic or conventional toward diversified agroecological systems where there will be more complexity more dynamic recycling of energy nutrients through the integration of...
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proper livestock, the ultimate use of space and local resources. The ultimate goal is to achieve technological self-sufficiency that is that the systems are able to do the functional biodiversity that they contain and are able to reach self-sufficiency.

For that in agroecology we use four fundamental principles: the spatial and temporal genetic and species diversity, the farming landscape level, it's very important to manage genetic diversity, species diversity of both plants and animals in the field but also the landscape level, the integration of crops and animals is becoming more and more important in the field, and I was glad to talk to colleagues about this. The biological activation of soils is very important. Not only are we interested in increasing complexity aboveground but also belowground and the high rate of biomass recycling in the system so that we have a constant use of outputs from one system an input in the other system, and the optimization of the use of the space that we call the agroecological design. You can organize the spatial and temporal arrangement in a very optimal way of utilizing the farm space. So those are the principles that we use and these principles are then translated into the design of the farming system.

These principles take different forms as I said before. Ecological farms, you can’t always integrate animals because some farms don’t have animals. So the recycling rates are provided by green manure. So this is a typical monoculture of organic lettuce but it has previously a green manure cover crop that has to be incorporated to the soil, typical peas, or faba beans or vetch that are incorporated into a soil before the planting of these varieties. Some farmers, instead of having the same varieties of lettuce will have different varieties which will confer some genetic diversity but also you can break the monoculture like in this case with Alyssum which is a plant which will attract beneficial insects especially syrphid flies that then will move into the system to control aphids which is the main pest problem that we have in that part of California on lettuce.

So you can see that designs can take different forms. There are also vineyards in California. There are organic vineyards, monocultures managed with input substitution. But we have been able to cut the external input by 80% in some of these farms by bringing diversity in the form of cover crops that provide nutrients to the soil structure, the soil fertility, but also start providing a habitat for beneficial insects. What happens is that most of the cover crops are planted in the fall and then they are cut or incorporated in the spring and then the system becomes virtual monocultures so what we’re very interested in is bringing summer cover crops, a diversity of flowers, like for example, buckwheat, Fagopyrum esculentum, that only uses their residual moisture left from the rains. There’s no irrigation here. And under the grape, because in California we have a sin of watering vineyards and I don’t that here you don’t, it’s like a sin to water the vineyards, I’m sorry I apologize, plant for example Alyssum that will not only protect against weeds but also some research is showing that it can have some very important biofumigation effects in the soil because it’s a crucifer. But what happens is that if this is May this plant will dry. So you need more flowers here during the summer especially until September, October, but we'll need a plant that will grow without water. So here in the middle there’s already planted strips of white carrots that will come up even without water because they have very big
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roots. Obviously these plants will flower in about July or August, and then in September if you don’t want to create a weed problem what you need to do is cut them. You avoid seed production otherwise you’re going to increase the weed seedbank. Sometimes we also cut the cover crops because many times the beneficial insects that they attract stay here. They don’t move to the vineyard. So you need to also cut in order to force movement. So there’s a whole management of this biodiversity that goes alone with incorporating diversity. And it’s not just any diversity, you have to bring plants that have a function, that we know are important, feeding the beneficial insects, that are providing habitat etc.

So here you can see one possibility of a sequence, a succession of flowers that are incorporated by some farmers. This is flexible. Farmers don’t have to follow all this. Some farmers will pick two species or one species depending on their needs, depending on their desires but this is just an example of a complex succession. Then obviously we are also finding that the surrounding matrix also is important in determining the diversity of beneficial insects in the system. Actually in Europe a lot of research was done years ago. I remember reading the books of some German and in Czechoslovakia saying that the forest was a very important source of carabid beetles and spiders and things like that.

The same thing happens in California but when you have fields surrounded by forests, these fields expand this way, it’s a gradient. Beneficials are very abundant near the forest. 50 or 60 meters. But then they decline and the pest problems emerge in these areas. So landscape ecology comes into place when you create corridors that connect to the forest allowing for the circulation of beneficial insects into the system. Many farmers are now working with this whole idea of reaching corridors and hedge rows, and things of that nature in the systems. Now in annual crops systems there’s a lot going on in diversification. In Argentina there’s a big 3000 acre farm. This is the legacy of transgenic soybean. A lot of erosion and degradation. But this farmer converted this particular piece of land that you see here in this. And what the farmer is doing is first of all leading corridors in the system, recovering some, restoring some and leaving them there because it’s a source of biodiversity. This area right now is under cover crops and then this area here will be planted with trees, fruit trees every five meters and then there will be permanent grassland in the system that will be managed with sheep in rotation with electrical fences. So the sheep are going to be circulating here through the system and in this area every year there will be complex crop systems like this. Instead of having polycultures on small farms, we’re going to have strips of different crops in a complex way, arranged with rotation so it’s going to bring temporal and spatial diversity to the system. So that’s one example of a large scale design that is actually being implemented in Argentina.

Some farmers especially in the North East of the United States, there’s a research group called Rodeo doing a lot of work on organic farming for many years, heard of the experience of the small farm in Brazil, about the no till organic and they developed a mechanized rolla faca as you can see here. So here you have these rollers going through the field. In this particular case, they only planted rye, *Secale cereale*, and then after they planted beans or soybeans. So you can see there’s no weed emergence, this is the residues that are decomposing having the allopathic
effect but you could design the system with strips of different crops. It’s doesn’t have to be a monoculture.

You can have strips of different crops that are going to complement each other and that way enhance the diversity of the system and the self-sufficiency. This efficiency obviously is reached in a much more rapid way with small farmers and the best examples of what we could call a post peak oil agriculturist Cuba, because you know that when the Soviet bloc collapsed 80% of the imports of pesticides, fertilisers and petroleum dropped in the island. Can you imagine if tomorrow in France we turned off 80% of the pesticides and fertilisers, what would happen with the agriculture? It would collapse. Which it did in Cuba but Cuba have very different characteristics than the rest of the world. One of them actually is that they have 2% of the Latin American population but 11% of the scientists. So they were able to mobilise human resources very quickly along with land reform, the creation of cooperatives and so on. And they use agroecological strategies, the diversification, all the principles that I was talking about. This is perhaps the most sophisticated material that you will find that some of the small farms have 5 to 10 hectares. They do a lot of innovation on biofertilisers that they produce. This is one example of a farmer who has 12 different crops but also has pigs. He obtains LER of 1.78, a very high efficiency in terms of land use.

But more importantly this farmer is able to feed with the production of one hectare 21 people with kilocalories and about 12.5 with protein from the pigs. With an energy efficiency ratio of 11.2 that is 1 kilocalorie obtained 11. This other farmer and his family are much more integrated than the one before with livestock, with a lot of spatial landscape biodiversity and crop rotations that are complex. This farmer is able to feed 34 people with protein from the production of one hectare with an energy efficiency of 30. So it puts one kilocalorie harvest 30, in the United States, the most efficient industrial system is 1.5. So we’re talking about almost 20 times the efficiency. There’s also a tremendous amount of work going on with the application of agroecological principles in urban agriculture especially in Cuba where there was an interruption of the transfer of food from the rural areas to the urban areas because of lack of petroleum, no transportation.

So very quickly, urban agriculture started sprawling in the island with the support of the government. The research and extension services specialising in urban agriculture. And they’re producing 50 000 hectares in urban agriculture right now, with a production that is about 10 to 20 kg per square meter of edible material, with no input of external chemicals, it’s all managed with the principles I told you and very high levels of productivity. In Oakland, California, where we live, there is a huge emphasis on urban agriculture especially in the minority neighbourhoods because of there’s strong food insecurity. There’s highest productivity in these gardens is 5, as opposed to 20 in some cases.

How do these innovations spread? That is what is called the Campesino a Campesino movement. Through a farmer to farmer horizontal exchange of information in which we, as scientists or researchers or extensionists, play a facilitating role. This is what happened in Cuba
after the special period from 200 families to 110,000 families just in ten years, the innovations started spreading from farm to farm. You can see that the percent contribution by the small farmers to the diet of Cuba before the special period was lower than after.

So peasant agriculture became more important after the crisis just in providing food for the people which is something interesting to see because what would happen if industrial agriculture collapsed just for lack of petroleum or huge prices of petroleum, political reasons, whatever. What would happen? Who would be feeding the population of France for example?

I’m sure here small farmers would have a huge role. There are a lot of initiatives going on in Brazil, Peru, Bolivia, Ecuador, Venezuela, many countries and in some cases there has to be political will to accompany the expansion of agroecology. So for example this is Santa Rosa Lima a little town in Southern Brazil, Parana, where the mayor is an organic farm owner. He got elected, he declared the region free of chemicals, the farmers integrated livestock, aquaculture, crop production systems, very efficient recycling in these farms, they produce milk, they produce wine, they produce chicken, they produce also fish and they produce crops of different kinds. These farmers are the ones that are providing the food through fairs that are local fairs to the local towns in which the commitment of the farmer is to sell their produce cheaper than conventional. This is the only place in the world where organic is cheaper than conventional.

So they create this loyalty between the farmers and the consumers through REDE ECOVIDA which has a different type of certification. It’s called Solidaris certification. But also there are some cases where they develop agro-industries because their market is called institutional market we have a colleague who could talk more about these things. Farmers have to provide food to the hospitals, to the schools, but you’re not just going to give tomatoes and lettuce, you have to give them chicken, milk, yoghurt and cheese and so on. So the agro-industries are very important and this would be an example of this “canasta”, this basket that needs to go to the market. I don't know if you’re familiar with the work of the European rural sociologist called J. Van der Ploeg, he’s in the Netherlands, he just wrote a very important book about the new peasantry. He says there’s agro-industry empires that controls what the producers will produce, with what inputs and so on. And we, the consumers, what we’re going to eat, how much we're going to eat, pay for our food, you know the Walmarts, Carrefours... but there's an alternative by-pass which is what he calls the peasant market. As an important kind of by-pass that could actually perhaps be much more equitable in terms of market and products. And this is embedded in a concept that did not emerge from academia but emerged from the social movements especially the Via Campesina one which is one of the largest peasant movements in the world called the food sovereignty. This movement is now being taken seriously by academics and by organisations like FAO. I think we have transcended this concept of food security.

However, there's a lot of discussion yet on whether we will accept this view of the “Via campesina” totally or “food sovereignty”. Because they say the most important is to protect small farmers from the free trade from WTO. There has to be access to land, access to seeds, and access to water, to land through land reform which is a topic that maybe here in France you
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You have to have the social movements that are going to be organized in cooperatives, settlements but also the State has to play a major role. So we have to have research but agroecological research. Extension, agroecological extension. Markets, alternative markets. Credit and all the services farmers need. So the State has to play a key role in protecting and facilitating the agroecological approach to bring the food sovereignty. But in addition to the food sovereignty, there are two other sovereignties: the energy sovereignty and the technological sovereignty.

That is farmers cannot continue depending on the matrix of industrial energy. They need to become independent. Technological sovereignty comes from the application of agroecological principles because you don’t need external inputs. I mean you need some but you don’t need this amount of organic or chemical or conventional, whatever, inputs. Because once you’ve designed the farm, once the infrastructure is working, then the system is able to sponsor soil fertility, plant protection, productivity and so on. And this is an example of small farmers in North Eastern Brazil for example, producing *Ricinus communis* for energy but intercropping with corn and beans which have been harvested or *Jatropha* in Cuba cropped every few rows with cassava. It’s possible to produce food and energy but that energy is for the needs of the farms not for entering into the global agro-fuel markets. And we could think then of indicators for food sovereignty, energy sovereignty, productive sovereignty, these are just examples.

For example in a particular region or cooperative, you could say, we will establish some thresholds for us to be food sovereignty we need to feed more than five people with the production of one hectare. Or more than ten people, whatever. Then the family food coming from outside the farm needs to be less than 30% and the contribution of the products that we produce in the farm to our nutrition has to be more than 70% for example. That’s just an example of threshold that could be used. The same thing goes for example things like productive sovereignty. The LER has to be higher than 1.5, the inputs from outside less than 30% or 25% and the crop diversity, the number of species interacting has to be higher than 3 or 5.

So in that way we can start setting certain threshold levels after which we would be reaching the sovereignties. This is just to conclude, there’s a study that came out of Bagley, from the University of Michigan with Hector Ruiz and Van der Meer. What they did is that they did a meta-analysis of 300 studies that compared the production of organic versus conventional and they found that the products, the crops, the animals, and you can see that when the value is
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higher than one, that means there’s a potential to increase production with agroe
cological methods. And interestingly enough from their paper, the potential to increase production at the
farm level is more in the South than in the North. They don’t go into the details of why it’s like
this.

Our own analysis and our own benefice this is solely because of cereal reason. One, we
have the germplasm, 1.9 million varieties that have been adapted to low input conditions, that
have been adapted to be managed in complex situations. There is the adhesion of knowledge,
the traditional millenary knowledge that farmers have about biodiversity, about managing natu-
ral resources and there is the social organization, the organization of farmers both political as
well as in markets, cooperatives and so on, that allows them to share information through the
Campasino a Campesino movement in various ways, but also to demand for their needs in a
much more efficient way. This is my interpretation, obviously open to discussion. There are
many initiatives that are going on in some countries about recognizing the importance of sus-
tainable agriculture, food sovereignty. There have been some very important reports that have
come out suggesting that the most viable path is agroecology, the IAASTD report as well as the
report of Olivier De Schutter, the UN special rapporteur of the right to food, basically saying
that we need a new paradigm, that agroecology is an important paradigm and that small farmers
will play a major role in the future. So with that, I just wanted to thank you and maybe open a
discussion.