Muñoz, Lucio, 2008. Agriculture and Global Warming: Should the Biofuel Route Be Expected to Be a Socially Friendly Agricultural Policy?, In: Biocombustibles, REDESMA, Vol. 2(2), Section VIII, July, La Paz, Bolivia.

Agriculture and Global Warming: Should the Biofuel Route Be Expected to Be a Socially Friendly Agricultural Policy?

By

Lucio Muñoz*

***Qualitative Comparative Researcher/Consultant, Vancouver, BC, Canada. E-mail: munoz@interchange.ubc.ca**

Abstract

It is now widely accepted that we need to deal with global warming issues immediately by greening production activities and by shifting from production and consumption of non-renewable energy to the production and consumption of a renewable one. Currently and consistent with the above, local and international organizations are promoting the implementation of a two component global warming friendly strategy that affects agriculture: a) The shifting to more environmentally friendly methods of agricultural production; and b) The redirection of part of agricultural production to the production of bio-energy in general and biofuels in particular. The implementation of both components of this global warming strategy in a rush, and especially without regulation, should be expected to have the potential to affect negatively social sustainability as they would affect perhaps deeply land use patterns in general and the availability and accessibility of agricultural commodities with high social value to the general population in particular.

However, not much emphasis is being placed by global warming advocates, economic and/or environmental, on making sure that these global warming friendly actions are implemented in ways that are as socially friendly as possible in the short and in the long-term. Ignoring, on purpose or not, the need to avoid implementing environmental solutions that have the potential to lead to deeper social unsustainability, especially in developing countries, creates a window of opportunity to increase and widespread social unrest and global unsustainability, which ultimately may backfire globally in environmental terms.

The main goals of this paper are: a) to introduce a general framework that links the green agricultural development model to agriculture supported renewable energy production or bioenergy and to global warming; and use it to highlight general expected impacts and policy implications arising from both the greening of agricultural production processes and from the general social use for bioenergy swap; and b) to introduce a component specific framework that links the green agricultural development model to biofuel production supported by industrial and traditional agricultural activities and to global warming; and use it to highlight general expected impacts and policy implications arising from both the greening of industrial and traditional agricultural production processes; and from the food for biofuels swap.

Introduction

Until recently, economic activity, including agricultural production, was taking place without any effort to eliminate or at least minimize environmental concerns. Today, there is an expectation that agricultural activities must be made global warming friendly. And there is the belief today too that agriculture can be made still more global warming friendly if it can be used to support the production of renewable energy commodities such bioenergy in general and biofuels in particular..

Below, a short overview of the step by step evolution of the agricultural development model from when it was totally unconcerned about environmental impacts to now when it needs to fully reflect global warming friendliness is provided to point out in simple terms graphically and analytically evolving general and component based model structures and linkages.

a) The general agricultural development before global warming was an issue

In general terms, it can be said that the agricultural development model(ADM) is out there to provide agricultural commodities(AP) to satisfy society's needs(A). As society needs have increased through time, so it has been the need to increase agricultural productivity. IAASTD(2008a) points out that in the last 60 years it has been possible to increase agricultural productivity due to the use of better germ plasm, the use of more inputs and the use of agricultural mechanization. And the general structure of the ADM model can be seen in Figure 1 below:

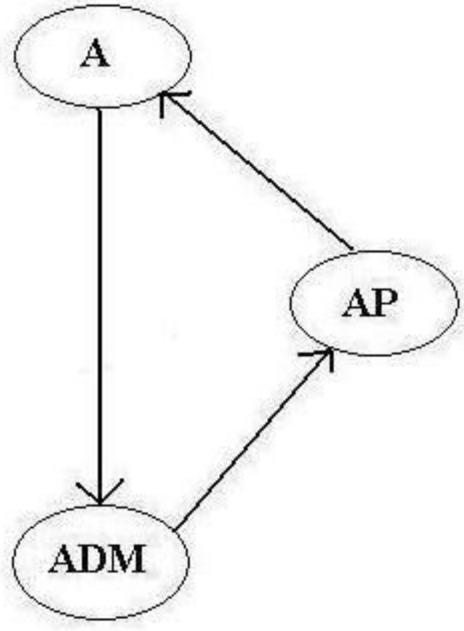

Figure 1 The Agricultural Development Model(ADM) before global warming became an issue
The goal of the ADM is to enable agricultural production(AP) to satisfy social needs(A); and social wants(A) drive the model.

Notice that in Figure 1 society(A) influences the dynamics of the ADM model and notice that no environmental concerns are shown in this model.

b) The component based agricultural development before global warming was an issue

To show historical consistency in terms of different types of agricultural production(AP) reflected in the agricultural development model(ADM) through time, it can be said it has had two clear periods: i) the traditional period: agricultural production(AP) was first supported by traditional production practices mainly and it was focused on traditional food production(TFP), which can be seen in part 1 at the right of Figure 2 below; and ii) The industrial period: later in the development of the model, a period of industrialization took place centered mainly on industrial food production(IFP), which can be appreciated in part 2 to the left of Figure 2..

It is generally accepted that the industrialization of agriculture begun with the seeds of the green revolution, a process that started to take good roots according to Ganguly(1998) in 1947. Then, it can be said that the traditional period in part 1 of Figure 2 corresponds to the period going from when men became sedentary to the year 1947 or just before the green revolution; and the industrial period in part 2 of Figure 2 corresponds to the period from the year 1947 or from the beginning of the green revolution to now.

And therefore, it can be stated that the agricultural development model(ADM) has evolved into one that provides now both traditionally(TFP) and industrially(IFP) produced commodities to meet the needs of society(A), as shown in Figure 2.

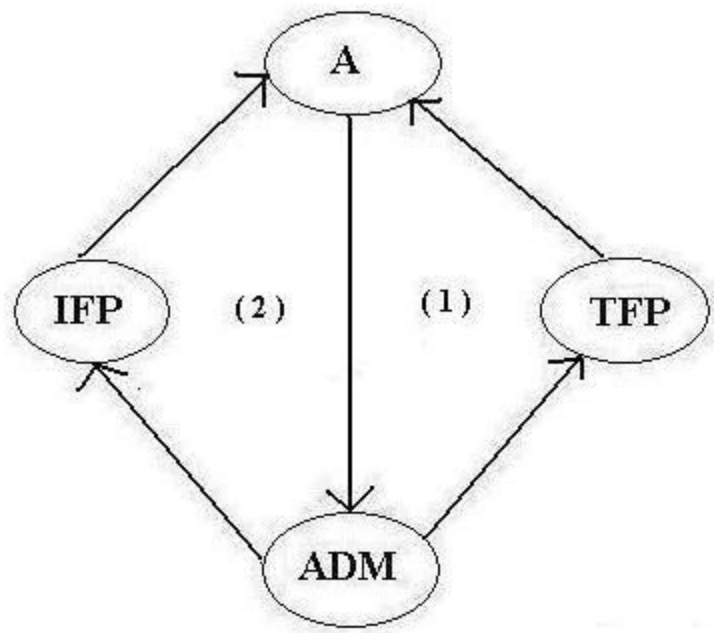

Figure 2 Evolution of the agricultural development model(ADM) First, the ADM model was focused only on traditional food production(TFP), then later it moved increasingly towards industrial food production(IFP).

Notice too that in Figure 2 society(A) influences the dynamics of the ADM model and also it can be seen that no environmental concerns are shown in that model..

Figure 2 also helps us to see the possibility that as land used to traditionally produced commodities(TFP) shifts towards land used to industrially produced commodities(IFP), the supply of traditional produced commodities(TFP) decreases if less land is produced traditionally. If the industrially produced agricultural commodities(IFP) were not for human consumption, as it is usually the case; and if the traditionally produced commodities(TFP) are for human consumption, then the prices of traditionally produced commodities(TFP) should be expected to increase due to a smaller supply, negatively affecting social sustainability(A).

c) Linking the general agricultural development and global warming

As global warming became a binding issue, then the need to reflect it in the ADM model became binding too. Figure 3 below shows the negative impact that agricultural activities(AP) have on global warming(GW), which were previously left out and unaccounted for. IAASTD(2008b) points out that leaving social and environmental concerns out of the agricultural model in the past was a mistake and that now we are in a position of correcting that situation.

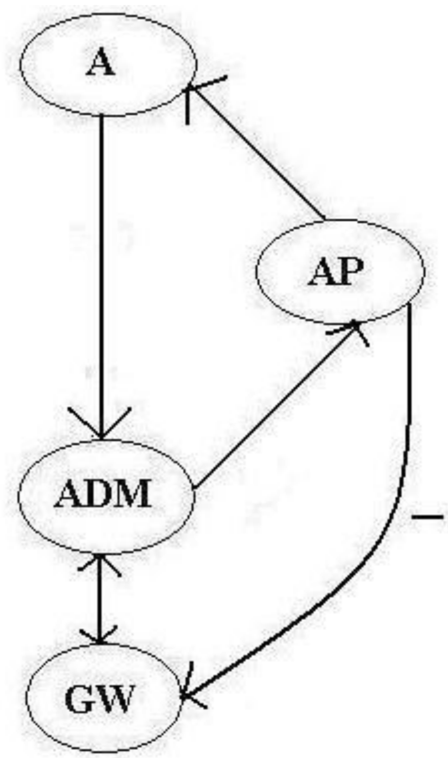

Figure 3 Linking the Agricultural Development Model(ADM) and Global Warming(GW).
It is now recognized that agricultural production(AP) is not environmentally friendly; and therefore, it contributes to the global warming problem(GW), which in turn affects the ADM model.

Notice that now in Figure 3 we can clearly see the negative impact that agricultural activities(AP) have on global warming(GW) and how global warming affects the agricultural development model ADM.

d) Linking the component based agricultural development and global warming

As both, industrial agricultural production(IFP) and traditional food production(TFP) are environmentally unfriendly; each of them has a negative impact on global warming(GW) which now needs to be included in the model as it can be seen in Figure 4 below:

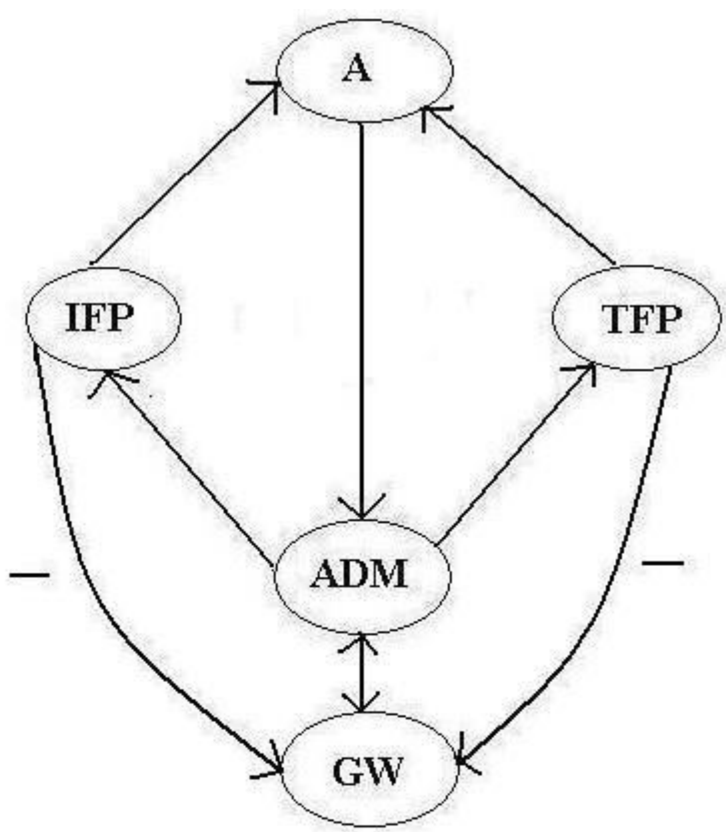

Figure 4 **Linking global warming(GW) to traditional(TFP) and industrial(IFP) food production**
Both traditional food production(TFP) and industrial food production(IFP) negatively affect global warming(GW).

.

IAASTD(2008c) indicates that both the environmental and social issues associated to traditional and industrial agricultural systems should now be recognized and appropriately managed to achieve further development and sustainability goals.

See that Figure 4 shows both the negative impact that traditional(TFP) and industrial(IFP) agricultural activities are having on global warming(GW) and how global warming affects the agricultural development model ADM.

e) The proposed solutions to the agriculture driven global problem issue

In general, it is believed today that global warming(GW) can benefit from agriculture in two ways: 1) by the greening of production processes; and 2) by redirecting some agricultural production processes towards supporting renewable energy programs such as bioenergy(BE) in general and biofuel production in particular. And consistent with that view, programs and policies, locally and internationally, are right now being directed at encouraging the implementation, in a kind of rushing way, of either one of those components or both at the same time, especially in developing countries.

If those global warming solutions were implemented in a very socially friendly manner, then they would be consistent with the socially sustainable solutions that can be extracted from Figure 3 and Figure 4, and they would be sustainable. However is not clear how society would be affected as the proponents, economists and/or environmentalists, of those global warming solutions based on agriculture say very little or nothing about what the expected impacts on social sustainability arising from implementing those policies will be. Just recently, the need to identify and implement only renewable energy solutions that are socially friendly if the goal is to create sustainable renewable energy markets was pointed out(Muñoz 2008). Just recently too, the need to look at the costs and benefits of bioenergy policies before implementation to make sure they lead to sustainable benefits was strongly stressed(IAASTD 2008b). Knowing what good and what harm can be expected from implementing the global warming agenda is very important to avoid unnecessary system complications now that we know that the global renewable energy industry in general, and the bioethanol and the biodiesel industries in particular have expanded at an spectacular rate from 2005 to 2007; and they are expected to expand more and fast in the future(REN21 2008).

f) The need to know the expected impact of the proposed solutions to global warming

Yes, there is a need to make economic activity including agricultural activity environmentally friendly, but the solutions prescribed to accomplish this must be at the same time global warming and socially friendly. In the case of biofuels, Doornbosch and Steenblik(2007) just recently raised the question, "Biofuels: Is the Cure Worse than the Disease? ", and the jury is still out there deliberating while the cure is still being implemented. Which raises another question, what if the medication makes you irreversibly sicker and irrational and induces a general system collapse?. Hence, there is a need to avoid creating unnecessary difficulties by avoiding to implement solutions that are expected to be socially unfriendly.

In other words, the greening process in agriculture and the type of renewable energy to be produced with the support of agriculture or bioenergy must be global warming and socially positive at the same time in order to be sustainable. Dealing with global warming through socially irresponsible policies would not work. An environmental fix that is good for global warming, but socially unfriendly has the potential to affect negatively the quality, quantity and accessibility of commodities of high social value to the general population via unaffordable prices, limited supplies, and speculation, undermining in the process its long-term success. Rossi and Lambrou(2008) stress that a) the biofuel industry is growing rapidly in term of scale and countries involved; b) that countries with potential of expansion are also food insecure; c) that the increase demand for biofuel has the potential to affect food prices and therefore food availability and access especially for consumers, the poor and women; d) the high profitability of biofuels may lead to land currently being used for food production and cattle production to be transferred to biofuel production affecting the availability of crops and livestock products; and e) that biofuel production may also unleash deforestation pressures on remaining natural areas.

Hence, the renewable energy fix based on biofuels expansion has a high potential, especially if left fully unregulated, to deeply affects social sustainability and food security for the poorest and weakest segments of society. Evans(2008) indicates a) that one of the factors leading to a global food price increase of 83% in the last three years is the use of crops to produce biofuels; and b) that the World Bank expects the demand for food to go up by 50% by the year 2030, which clearly shows how easy it can be for biofuel expansion policies to quickly drive food prices even higher while leading to a decreasing global supply of food at the same time that the global population grows. Notice that if all land under agricultural production remains under agricultural use to support the social market, then we can expect the coming of technological fixes that would ensure that the productivity increases needed to feed a growing population take place. But if farmers can make more money supplying the biofuel industry, then the technological fixes that we are more likely to see coming are those technological fixes that will provide more and cheaper, perhaps new and improved, but not good for human use, agricultural material to the biofuel industry, not the technological fixes needed to feed more people as land under agricultural use for the purpose of supplying society would increasingly be less and less while the biofuel industry gets bigger and bigger.

If we are to succeed in reaching the Millennium Development Goals(MDGs) we need to avoid implementing environmental policies(e.g. renewable energy or global warming policies) that put poverty programs and food security at risk. It is known that top issues reflected in the MDGs are to find ways to reduce poverty, achieve food security and achieve environmental sustainability at the same time(FAO 2007), hence achieving one goal should not drag the other goal down, but this seems not to be the case with biofuels.

Yet, most organizations promoting the proposed global warming solutions or those promoting the development of renewable energy in general provide little or no information about those possible social externalities. For example, REN21(2008), a global network of organizations promoting the development and use of renewable energy globally, points out only the virtues of renewable energy as a way of reducing CO2 emissions, improve energy security, and generate economic development and how far this industry has gone in a very short time, it says nothing about the need to promote only those forms of renewable energy that are socially friendly to avoid inducing persistent food insecurity and perhaps the total collapse of food markets.

In other words, no much is said about the expected social consequences of implementing that global warming solution. What would be the expected impact on society from the greening process in agriculture?. What would be the expected impact on society from redirecting agricultural production to support renewable energy policies such as bioenergy production in general and biofuel production in particular?. Which are the expected policy implications arising from those situations for governments, donors, and international organizations?.

This paper is aimed at providing a simple way to identifying and presenting analytically and graphically answers to those expectations.

Goals of the paper

The main goals of this paper are: a) to introduce a general framework that links the green agricultural development model to agriculture supported renewable energy production or bioenergy and to global warming; and use it to highlight general expected impacts and policy implications arising from both the greening of agricultural production processes and from the general social use for bioenergy swap; and b) to introduce a component specific framework that links the green agricultural development model to biofuel production supported by industrial and traditional agricultural activities and to global warming; and use it to highlight general expected impacts and policy implications arising from both the greening of industrial and traditional agricultural production processes; and from the food for biofuels swap.

Methodology

First, the terminology used to present the ideas in this paper are listed. Second, some operational concepts are provided. Third, a general diagram is pointed out showing how the general green agricultural development model looks when greening production takes place and when supporting renewable energy policies or bioenergy together with expected impacts on global warming and social sustainability and policy implications. Fourth, a component specific diagram is introduced indicating how the green agricultural development model looks when greening industrial and traditional production processes is achieved and when supporting the production of biofuels together with expected impacts on global warming and social sustainability and policy implications. Fifth, some food for thought is stressed. And finally, some relevant conclusions, specific and general, are given.

Terminology

The terminology used to present the ideas in this paper is listed below:

Table 1

A = Society/Social sustainability	AP = Agricultural production
ADM = Agricultural development model	GW = Global Warming
TFP = Traditional food production	IFP = Industrial food production
NA = Natural area	AUU = Area under use
AU = Area under agricultural use	π AUU = Profit of area under use is higher
AFP = Agricultural food production	APBF = Agri-production for biofuels
π APBF = More profits in fuel production	BE = Bioenergy
π AU = agricultural profit is higher	π AFP = Profit of food production is higher
CHSV = Commodity of high social value	πi = Profits of CHSV

CLSV = Commodity of low social value	πj = Profits of CLSV
GWP = Global warming price	P = Normal price
GM = Green margin	SM = Scarcity margin
ASRE = Agri-supported renewable energy	GAP = Green agricultural production
GADM = Green agri-development model	BF = Biofuels
GTFP = Green traditional production	GIFP = Green industrial production

---

Operational concepts

The following concepts and expectations are used to present the ideas in this paper.

a) Expected land use change

We should expect land uses to go from low value to high value land uses. In other words, land conversion from one land use to another follows the higher value pull. This can be seen clearly in Figure 5 below:

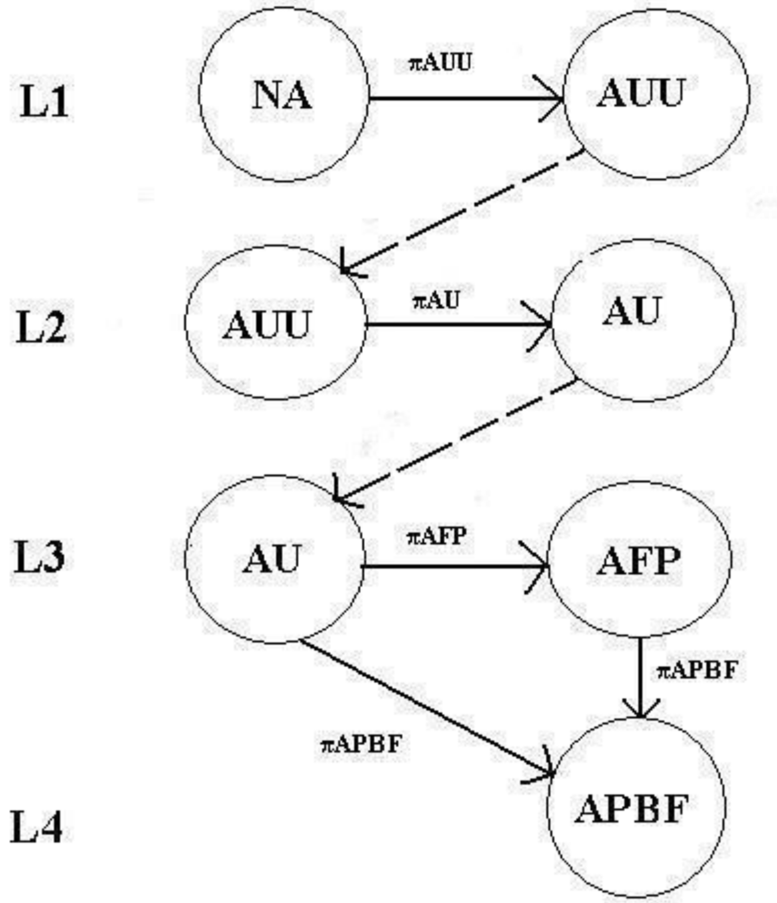

Figure 5 Expected land use patterns without regulation
We should expect land use conversion to go from the less profitable use to the most profitable one.

.

As shown in Figure 5 land use conversion, as indicated by the arrows, goes in the direction where higher profitability is found. For example, profits from areas under use(AUU) are higher than profits from natural areas(NA) and therefore, without regulation, we should expect land conversion to take place and to see less natural areas(NA) and more areas under use(AUU).

b) Levels of land use dominance

As shown in Figure 5, without regulation, we can see four possible levels of land use dominance: i) Level L1, where dominant land use goes to area under use(AUU); ii) Level L2, where dominant land use goes to agricultural activities(AU); iii) Level L3, where dominant use goes to agricultural food production(AFP); and iv) Level L4, where dominant land use goes to agricultural production for biofuels(APBF).

c) Expected land use concentration

Without regulation, we should expect the land conversion process to end up at the land use with the highest value. Figure 5 shows that if the price is right for land uses supporting the production of biofuels(APBF), then we should expect all land under agricultural use(AU), including land used currently for food production(AFP) to be converted to land uses supporting biofuel production(APBF). And this higher profitability in land uses supporting biofuel production(APBF) will also put pressure on the conversion of remaining natural areas(NA) beginning with those not yet protected ; and of areas under use(AUU), but not currently in agricultural use(AU) to be used for supporting APBF land use. Figure 5 also helps us to see the following: a) that only when markets for areas under use(AUU) collapse, we can expect the natural area(NA) to increase; b) that without effective protection, remaining natural areas(NA) would sooner or later be under pressure to be converted into other uses; and c) that as the land use for biofuels(APBF) expands, the more positive its impact on global warming(GW) and the more negative its impact on the pressures to convert remaining natural areas(NA) to other uses(AUU).

d) Commodities with high social value(CHSV)

Commodities without which societies, especially the poor, can not meet their basic food and cultural needs such as corn, rice, beans, oils…are considered agricultural commodities with high social value(CHSV).

e) Commodities with low social value(CLSV)

Commodities that are irrelevant to meet the basic food and cultural needs of societies such as agricultural production for livestock use, biofuels.…are considered commodities with low social value(CLSV).

f) Expected price consequences when moving from high social to low social value commodities

If the profit that farmers can get from producing commodities with low social value(CLSV) is higher, they will increasingly produce more commodities of low social value(CLSV) and less commodities of high social value(CHSV), affecting supplies and prices. For example, if agricultural production for human consumption is less profitable than agricultural production for animal consumption, other things being equal, more agricultural production for animal consumption should be expected to take place, affecting supplies and prices. If agricultural production for human and animal consumption is less profitable than production for biofuel production, ceteris paribus, more production for biofuel production should be expected to take place, affecting supplies and prices. This situation that can be clearly seen in Figure 6 below:

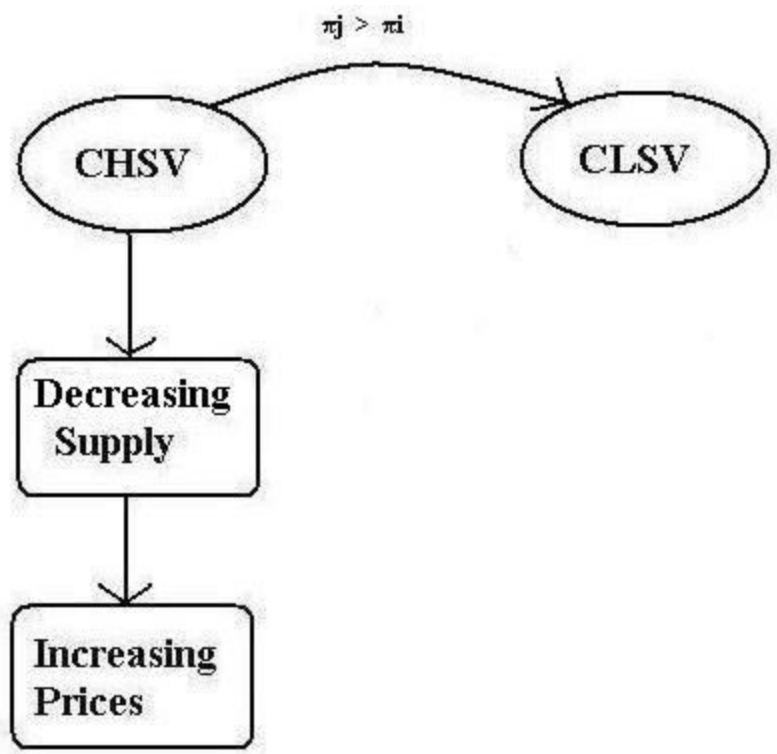

Figure 6 Linking land use changes and commodity price changes
The expected consequence of shifting agricultural production from commodities with hight social value (CHSV) to commodities with low social value(CLSV) is an increase in price in the CHSV due to decreasing supply.

Figure 6 clearly shows that as less commodities of high social value(CHSV) are produced, its lower supply leads to increases in their prices.

g) Expected consequences of decreasing supplies in commodities of high social value

As the supply of commodities of high social value(CHSV) decreases, the prices of the commodities making up the basic food and cultural basket are expected to increase, and the risk of social unrest is expected to increase too as it can be observed in Figure 7 below:

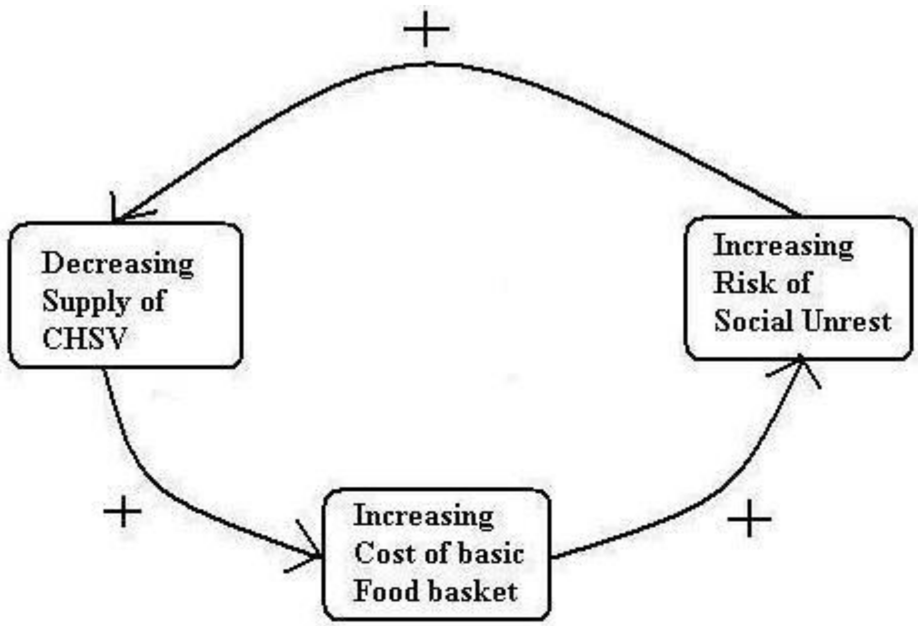

Figure 7 The expected cycle of social unrest
Decreasing supplies of commodities with high social value (CHSV) have a positive impact on increasing the cost of basic needs, which in turn initiates and sustain cycles of social unrest over increasingly less and less supplies of CHSV

Figure 7 clearly expresses the idea that expected decreases in the supply of commodities of high social value(CHSV) lead to expected increases in the cost of the basic consumer food basket, which in turn leads to expected increases in the risk of social unrest creating that way an expected cycle of social unrest. As prices of commodities of high social value(CHSV) reach or go above the point of no affordability, social unrest should be expected.

h) Direct biofuel induced social impact

There is a direct biofuel induced social impact when commodities fit for human consumption(e.g. corn) and therefore of high social value(CHSV) are taken out of the social market and directed to the biofuel producing market by farmers seeking higher profits, decreasing supplies and increasing prices. We should expect the farmers to follow the profitability rule to choose where to sell the commodities of high social value they have currently at hand and if the biofuel price is right, we should expect them to empty the social market and run to the biofuel market.

i) Indirect biofuel induced social impact

There is an indirect biofuel induced social impact when the production of commodities of high social value is increasingly substituted for production of commodities of lower social value to be used to produce biofuel by farmers seeking higher profits, decreasing supplies and increasing prices. We should expect farmers to follow the profitability rule when deciding what to produce more and what to produce less; and if the biofuel price is right we should expect them to abandon the production of commodities of high social value and to produce only commodities of low social value for the biofuel market.

j) Global warming induced price(GWP)

The normal price(P) plus the green margin(GM) plus scarcity margin(SM) is considered here the global warming price(GWP). The normal price(P) is the price of a commodity before global warming became an issue. The green margin(GM) is the expected increase in price reflecting the cost of the greening process and added to the original price(P). The scarcity margin(SM) is the expected increase in price coming from the existence of a declining supply or speculation and added to the original price(P).

GWP = P + GM + SM

It can be seen in the formula above that the higher the cost of the greening process and therefore, the higher the green margin(GM); and the lower the supply of commodities and therefore the higher the scarcity margin(SM), the higher the global warming price(GWP) will be. And the higher the global warming price(GWP), the higher the possibility of unleashing the expected cycle of social unrest presented in Figure 7.

Making the general agricultural development model global warming friendly

As shown in Figure 3, global warming(GW) is linked negatively to agricultural production processes(AP), something that needs to be corrected. As mentioned in the introduction, besides promoting the greening of agricultural activities(GAP), global warming advocates are also calling for the use of agricultural production as a source to support the production of renewable energy(ASRE) or bioenergy(BE), a proposed solution that can be appreciate in Figure 8 below.

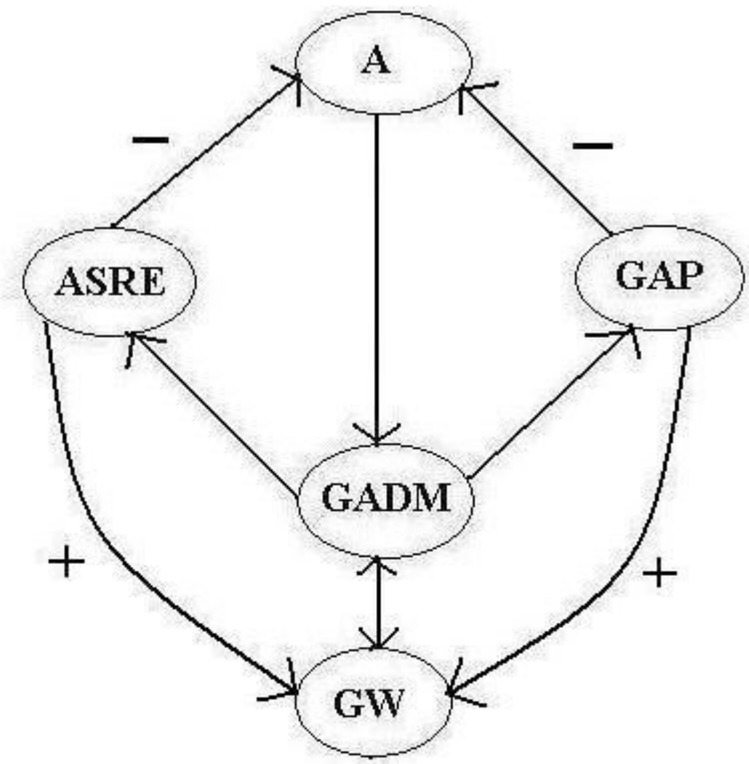

Figure 8 The Green Agricultural Development Model(GADM)
The GADM model addresses the global warming issue (GW) in two ways: a) The greening of agricultural production(GAP); and b) to direct some agricultural activities to support renewable energy policy(ASRE).

The following aspects can be deducted from Figure 8 above:

a) Expected positive impacts on global warming

Figure 8 shows that both the greening of the agricultural process(GAP) and the use of green agricultural activities to produce renewable energy(ASRE) or bioenergy(BE) are expected to have a positive impact on global warming. And this is good news for economic and environmental stakeholders as these approaches are expected to produce economic and environmental benefits at the same time.

b) Expected negative impacts on social sustainability

Figure 8 indicates that both the greening of the agricultural process(GAP) and the use of green agricultural activities to produce renewable energy(ASRE) or bioenergy(BE) are expected to have a negative impact on social sustainability. This is because the normal price of commodities(P) is expected to increase by both the green margin(GM) associated to the additional production cost due to the greening process and by the scarcity margin(SM) that it is triggered when more and more agricultural land is used to produce commodities to support renewable energy or bioenergy production as doing this decreases the supply of commodities with social value. In other words, the global warming price(GWP) for agricultural commodities with social value will be higher than the initial price(P), and for people who were or are already(the majority) swimming in shallow social sustainability with the initial price(P), the global warming price(GWP) may mean living in full social unsustainability. This situation should be bad news for all, economic, environmental, and social stakeholders as the prospect of pushing the system into full unsustainability with the current global warming friendly proposal for agriculture helps no one and affects everyone.

c) Policy implications:

Consistent with Figure 8 and without regulation, if the agricultural profit from supplying commodities for social use is less than the agricultural profit from supplying renewable energy or bioenergy producing processes, then simple economic theory suggests that an empty socially oriented market and a full renewable energy or bioenergy producing market can be created and with it the coming of persistent social unrest. As shown in Figure 6 and Figure 7, as the quantity of commodities with high social value(CHSV) decreases and their prices increase due to the implementation of the global warming friendly agenda, the expected risk of unlocking the cycle of social unrest increases. Under these conditions, it would be impossible for FAO to achieve food security, impossible for the World Bank to address poverty issues, and impossible for United Nations Agencies to meet the Millennium Development Goals(MDGs).

If the renewable energy or bioenergy market producing price is right, all agricultural land suitable for the production of material for bioenergy, including agricultural land dedicated to the production of goods for human and animal consumption, will be farmed for renewable energy or bioenergy production; and when doing this additional pressure on remaining natural areas to be converted into other uses and ultimately into renewable energy or bioenergy production farms will be constantly present. In other words, as the size of the agricultural land area dedicated to bioenergy production increases, the unintended consequence of this global warming friendly solution would be, to nurture the pressures that will lead to the conversion of remaining natural areas, especially those not yet protected, to other uses. And this is consistent with the expected land concentration patterns without regulation introduced in Figure 5.

Notice that the main threat that agriculture supported renewable energy(ASRE) or bioenergy production(BE) brings to social unsustainability comes not from the fact that agricultural crops with social value are being sent to the renewable energy producing market instead of the socially oriented market, but from the fact that higher expected profits in the renewable energy market will lead through time to more and more land that was originally used to supply socially valued goods now dedicated only to the production of renewable energy producing material. And these direct and indirect impacts make renewable energy programs supported by agricultural production or bioenergy programs among the most socially unfriendly policies in the arsenal against global warming suggested and promoted so far.

Making the component based agricultural development model global warming friendly

As indicated in Figure 4, global warming(GW) is linked negatively to traditional agricultural production processes(TFP) and to industrial production processes(IFP), a situation that needs to be addressed in environmentally friendly ways. Again, as mentioned in the introduction, the proposed global warming friendly solution to the agricultural production problems has two components: the greening of both traditional(GTFP) and industrial(GIFP) agricultural activities; and the use of some of that production to produce biofuels(BF), a situation pointed out in Figure 9 below:

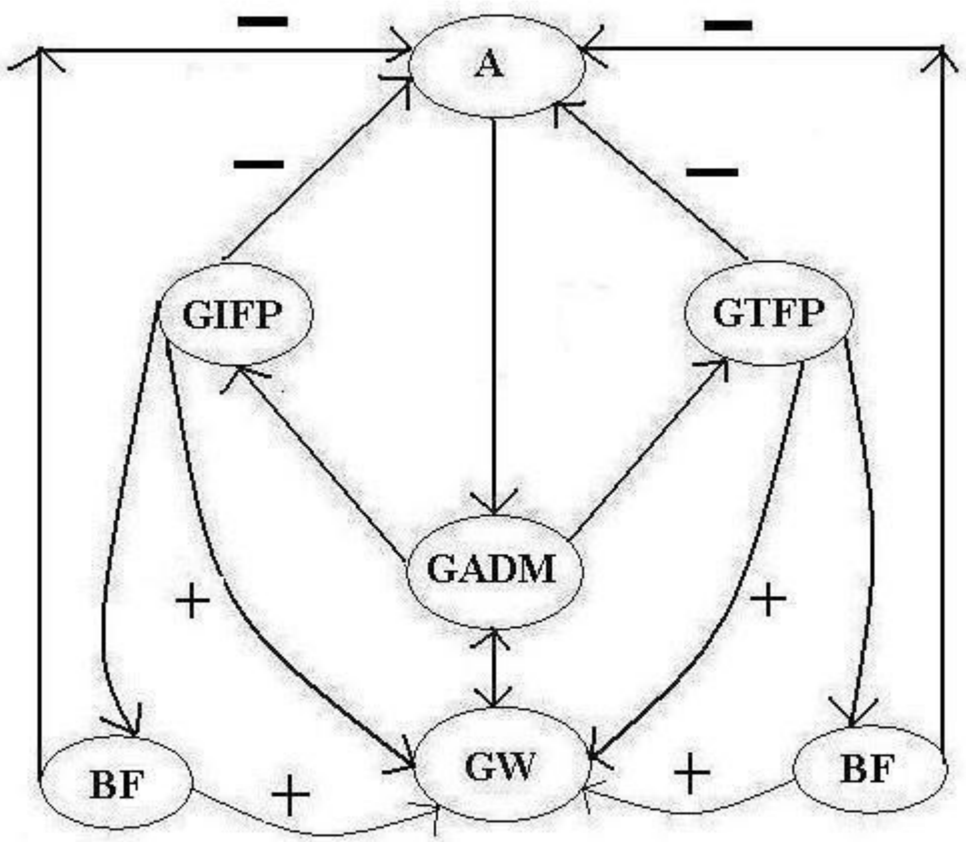

Figure 9 **Negative social consequences and global warming(GW) Both the greening of traditional(GTFP) and industrial(GIFP) food production and the use of food production to produce biofuel(BF) can affect society(A) negatively.**

The following implications can be extracted from Figure 9 above:

a) Expected positive impacts on global warming:

As shown in Figure 9, all, the greening of traditional agricultural process(GTFP), the greening of industrial agricultural activity(GIFP). and the use of green agricultural activities to produce biofuels(BF) are expected to have a positive impact on global warming. Again, this is good news for economic and environmental stakeholders promoting them as these approaches are expected to produce economic and environmental benefits at the same time.

b) Expected negative impacts on social sustainability:

As indicated in Figure 9, all, the greening of traditional agricultural process(GTFP), the greening of industrial agricultural activity(GIFP). and the used of green agricultural activities to produce biofuels(BF) are expected to have a negative impact on social sustainability.

See that the normal price of agricultural commodities produced traditionally(GTFP) and industrially(GIFP) is expected to increase by both the green margin associated to the additional production cost linked their own greening processes; and by the scarcity margin that it is triggered when more and more agricultural land is used to produce commodities to support biofuel production, decreasing the supply of both commodities produced traditionally and industrially for social value.

In other words, the global warming prices for traditional and industrial agricultural commodities with social value will be higher than their initial prices, and again for people who were already(the majority) swimming in shallow social sustainability with the initial prices, the global warming prices for traditional and industrially produced commodities available to society may mean swimming in full social unsustainability. Again, this situation should be bad news for all, economic, environmental, and social stakeholders as the prospect of pushing the system into full unsustainability with the implementation of the proposed global warming strategy as it is helps no one and affects everyone.

c) Policy implications:

Consistent with Figure 9 and without regulation, if the agricultural profit from supplying traditional and industrial commodities for social use is less than the agricultural profit from supplying biofuels producing processes, then simple economic theory suggests that an empty traditional and industrial market and a full biofuel producing market can be created and with it the coming of persistent social unrest. Again, as shown in Figure 6 and Figure 7, as the quantify of commodities with high social value(CHSV) decreases and their prices increase due to the implementation of the global warming friendly agenda, the expected risk of unlocking the cycle of social unrest increases. Again, under these conditions, it would be impossible for FAO to achieve food security, impossible for the World Bank to address poverty issues, and impossible for United Nations Agencies to meet the Millennium Development Goals(MDGs).

If the biofuel market producing price is right, all agricultural land suitable for the production of material for biofuel production, including agricultural land dedicated to the production of goods for human and animal consumption, will be farmed for biofuel production; and when doing this additional pressure on remaining natural areas to be converted into other uses and ultimately into bioenergy production farms will be constantly present, especially without regulation. In other words, an unintended consequence of a global warming friendly policy such a biofuel production is that as it expands, it will be good for global warming, but bad for remaining natural areas as the pressures to convert them to other uses will be higher. And again this is consistent with the expected land concentration patterns without regulation introduced in Figure 5.

Notice that the main threat that biofuel production brings to social unsustainability comes not from the fact that agricultural crops with social value are being sent to the biofuel producing market instead of the socially oriented market, but from the fact that higher expected profits in the biofuel market will lead through time to more and more industrially and traditionally oriented land use, which originally was farmed to supplying socially valued goods, to be now dedicated to the production of biofuel material. And these direct and indirect impacts make bioenergy policies like biofuel production among the most socially unfriendly policies in the arsenal against global warming suggested and promoted so far.

Food for thoughts

The situations presented in Figure 8 and Figure 9 above pose the following policy questions: Should local governments, donor countries; and international organizations such as FAO, WB, IMF and environmental NGOs continue to promote the implementation of this general or component based global warming agenda as currently proposed or should they take a second more careful look at it to ensure social friendliness?. Should current and future land reform processes be implemented without a clearly defined social sustainability requirement or should they be left too under the spell of the free market and move in the end towards where the profits are, the bioenergy/biofuel producing market?. Should we abolish the use of agricultural production to support renewable energy programs that are socially unfriendly and remove once and for all this source of social unsustainability?. If higher agricultural profits are expected to be in the bioenergy/biofuel production market, then land use concentration to produce for this end will take place, from where will food then come from?.

Specific conclusions

It was shown in Figure 8 that the greening of the general agricultural development model and the use of agricultural production to support renewable energy or bioenergy producing programs are expected to have a negative impact on social sustainability as they are expected to raise the original price of commodities by the combined effect of the green and scarcity margins. It was shown in Figure 9 that the greening of the traditional agricultural processes, the greening of industrial agricultural processes, and the use of agricultural production to support biofuel producing programs are expected to have a negative impact on social sustainability too as they also are expected to raise the original price of industrially and traditionally produced commodities remaining in the socially oriented market by the combined effect of the green and scarcity margins. In both cases, it can be seen that the implementation of global warming friendly policies are associated with socially unfriendly results; and therefore, decision makers should act with caution.

General conclusions

The negative links between agriculture and global warming were pointed out as well as the general and component specific solution to the agricultural development problem. It was stressed that the use of agricultural production to support renewable energy or bioenergy producing programs is expected to be a very socially unfriendly environmental policy as it has the potential to fully crowd out the production of agricultural commodities for social use in general; and the production of commodities with high social value in particular as farmers would be more attracted by the profitability found in supplying the bioenergy producing market. In other words, it was indicated that the biofuel route should not be expected to be a socially friendly agricultural policy, especially in the absence of regulation.

References

Doornbosch, Richard Ronald Steenblik, 2007. ***Biofuels: Is the Cure Worse than the Disease?,*** OECD, Paris, France.

Evans, Alex, 2008. ***Rising Food Prices: Drivers and Implications for Development***, Briefing Paper, Centre on International Cooperation, New York University, UK.

Food and Agriculture Organization(FAO), 2007. ***The State of Food and Agriculture: Paying Farmers for Environmental Services,*** Rome, Italy.

Ganguly, Saby, 1998. ***Report: From the Bengal Famine to the Green Revolution***, India.

International Assessment of Agricultural Science and Technology for Development (IAASTD), 2008a. ***International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD): Global Summary for Decision Makers*,** Washington DC, USA.

International Assessment of Agricultural Science and Technology for Development (IAASTD), 2008b. ***Executive Summary of the Synthesis Report of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)***, Washington DC, USA.

International Assessment of Agricultural Science and Technology for Development (IAASTD), 2008c. ***International Assessment of Agricultural Science and Technology for Development (IAASTD): Latin America and the Caribbean Summary for Decision Makers***, Washington DC, USA.

Muñoz, Lucio, 2008. Renewable Energy Vrs Social Needs: What Do Environmentalists Must Do to Induce the Development of a Sustainable Market fueled only by Renewable Energy?, In: ***Agrocombustibles***, REDESMA, Vol 2(1), Section VII, March, La Paz, Bolivia.

Renewable Energy Policy Network for the 21st Century(REN21), 2008. ***Renewables 2007: Global Status Report***, Paris, France.

Rossi, Andrea and Yianna Lambrou, 2008. ***Gender and Equity Issues in Liquid Biofuels Production Minimizing the Risks to Maximize the Opportunities***, FAO, Rome, Italy.

Muñoz, Lucio, 2008. Agriculture and Global Warming: Should the Biofuel Route Be Expected to Be a Socially Friendly Agricultural Policy?, In: Biocombustibles, REDESMA, Vol. 2(2), Section VIII, July, La Paz, Bolivia.