

ILUC project AC Meeting Minutes

Meeting: ILUC AC meeting
Date: 23 and 24 January 2013

Attendees: Daan Peters (chair, Ecofys) Carlo Harmelinck (Ecofys), Hugo Valin, Stefan Frank (IIASA), Maarten van den Berg (E4tech), Jacinto Fabiosa, Koen Overmars, Robert Edwards, Andre Nasser, Chris Malins, Richard Plevin, Alexandre Gohin, Prem Bindraban

Absent: David Laborde

Minutes by: Maarten van den Berg, Daan Peters, Hugo Valin

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Ecofys, IIASA and E4tech perform an ILUC modelling study for the European Commission. ILUC emission values for conventional and advanced biofuel feedstocks will be modelled using the GLOBIOM partial equilibrium model, developed by IIASA. The consortium established a scientific advisory committee (AC) which will provide advice at several key moments during the project. On 23-24 January 2014, a plenary meeting with the AC was held. A summary of what was discussed during the interviews is provided below. Note that no voting took place in the AC. On some issues a majority of AC members supported a certain advice to the consortium, while other pieces of advice were supported by fewer AC members. More widely supported advice has been included in the 'Inventory of suggested improvements to GLOBIOM' and the 'Proposal for a baseline and scenarios', both of which are published on www.globiom-iluc.eu

Agenda 23 January

1. Welcome, Introduction of project and its timeline
2. Consolidated minutes of individual interviews
3. Inventory of suggested improvements to the GLOBIOM model
4. Any Other Business
5. End

Agenda 24 January

1. Welcome
2. Inventory of suggested improvements to the GLOBIOM model
3. Proposal for a modelling baseline, feedstock scenario's, policy scenario's and sensitivity analysis
4. Any Other Business
5. End

Minutes 23 January

1. General points concerning the project

- Is the role of the AC to decide on the final proposal for changes to GLOBIOM and modelling baseline and scenarios or is it advice only?
- Ecofys: the role of the AC is to provide advice, which is very important to the consortium.

a. Timing of the consultation for improvements

- One AC member feels that the consortium proposes to change (improve) the model before knowing exactly which modelling problems might arise without the improvements being made. It is difficult to propose relevant improvements before knowing their exact impact on modelling results.
- The consortium explains that the project does not allow running the model first without the suggested improvement and then running the model again with the suggested improvement, this would be too time consuming. There is always a 'risk' to find unexpected problems along the way. That does not mean that these issues will not be tackled. Improvements can still be made when working on the first set of results. As the AC is familiar with modelling and also with the way models behave in response to shocks such as biofuel policies, it should have already good ideas on what the most important points to improve are. Modelling land use change is a complex task; there will still be room for further improvement outside of this project and some follow-up activities to continue developing GLOBIOM.

b. Model validation

- One AC member would like to know whether there is a way of validating this programming approach (like with econometric modelling)? There should be some validating activities that would be independent of the scenario testing. It would be good to see a validation of the modelling approach.
- IIASA: There are a certain number of ways of approaching the question of validation. First, as a baseline starting in 2000 will be set up and it will be possible to compare the results for 2010 with statistical data. Using the model to do some backcasting before 2000 is however difficult as it would require to have all the datasets for a prior year, and they do not exist. Another approach will also be to identify how the model extends the past trends, whether it prolongs historical observations or show a break between the past data and the projections that cannot be explained. This approach, however, does not constitute a validation in the same sense as for econometric models. In GLOBIOM, as in CGE models, the information on past behaviours is provided through elasticities and transaction costs. Values of these elasticities are important and more insight will be provided on model behaviours in terms of supply and demand elasticities. A decomposition of effects will also be performed (contribution of demand, yield, etc.).
- AC member agrees, point raised is the importance to separate the research issue from the modelling methodology.
- Ecofys: stakeholders are interested in the robustness of the model on certain types of responses. We will do some checks and be transparent on these behaviours.
- AC member: given the size of the model, a package of validation questions could be useful.
- Ecofys indicates that many questions have been received from stakeholders which could serve as starting point for these checks.

- One AC member reports on the difficulty to perform the decomposition of results with some models. The calculation for area versus yield is usually straight-forward, but decompositions for by-products and demand is more delicate.

2. Consolidated minutes of individual interviews

- A consolidated version of the individual interviews with AC members is discussed. AC agrees that minutes will be published at www.globiom-iluc.eu

3. Inventory of suggested improvements to the GLOBIOM model

Note1: The consortium gives priority for discussion in the plenary session to items classified as 'high priority'.

Note 2: the item numbers used in this document are the same as in the "Inventory of suggested improvements" document.

- AC asks whether the "priority" column indicates how high the impact on the modelling result is. IIASA confirms that this is indeed the case. One AC member suggests to link improvements to the scenarios where possible. In addition, when a parameter is targeted in the sensitivity analysis, it is suggested not to put too much effort on the improvement of that parameter.
- *Item 1 – Agricultural residues.* One AC member notes that when looking at straw, the issue is more on availability than on ILUC effects. This improvement could be simplified by looking at economics. For instance, in the UK, energy utilities pay farmers for their straw. It is possible to estimate the yield reduction of the main crop resulting from higher removal of straw on the basis of this price information. The ILUC effect from straw removal could be deducted from such approach. Ecofys notes that straw prices vary considerably across the EU due to the fact that straw is traded over relatively short distances (high transport costs), so UK prices differ from prices elsewhere. Obtaining reliable and complete information on straw prices is difficult, Ecofys managed to collect price information for a number of MS. Ecofys estimates that in general a removal rate of 40% for wheat straw can be safe, although local circumstances differ. JRC might also have additional data on straw. IIASA concludes that it is not so straight forward to include all these parameters in the model and perhaps a simplified approach can be taken. AC warns that it is impossible to calculate the loss of production for all member states. Also, it seems that there is no uniform 'safe' removal rate. It very much depends on the local circumstances. One AC member notes that USDA might have useful information on straw removal rates. However, it is mentioned that effects of straw removal as studies by USDA mainly focuses on impact on erosion and not so much on crop yield.
- *Item 4 – carbon stock.* One AC member explains that sugar cane can indeed be seen as a perennial crop but that there is no consensus on that. Ecofys suggests removing the explicit mention to perennial versus annual (item 5) to avoid this debate. One AC member explains that CARB has already looked at how to incorporate such carbon stocks in models. It is suggested that IIASA looks at this approach. Also, considering the uncertainty on these parameters, these should be targeted by the sensitivity analysis and not devoted too much effort. With respect to carbon stocks in crops, it is also standing biomass, no need to distinguish between annual and perennial crops.
- *Item 7 – carbon stock.* One AC member states it would be worth to check the palm NODA study from EPA and the subsequent comments. E4tech received information from Wetlands International and there does not seem to be agreement on the emission factors. IPCC sounds authoritative but their new estimate appears challenged by some literature findings. The consortium will come with a proposal on a range of plausible values. AC suggests that if values are so much debated, they should be treated through the sensitivity analysis.

- *Item 8 – Carbon stock.* AC discusses what SOC maps are currently publicly available. One AC member points to the current work led by Holly Gibbs to provide for the GTAP database a SOC map at country x AEZ level. This database is 99% along the review process and could be shared with the consortium. IIASA asks about the resolution level of the data. If the aggregation is at the country level, it would require using aggregated numbers anyway and IPCC figures could also be used. JRC also could provide some data on SOC. One AC member mentions the information available through ISRIC that also works on this issue and may have spatially explicit data. AC finally suggests not to go for IPCC but to try using more detailed data like the country x AEZ level if that it is available. IIASA agrees but will have to check how whether these data can be reconciled consistently with the current land use database of GLOBIOM.
- *Item 9 – Forest reversion.* IIASA: Values for forest regrowth after 20 years need a specific treatment as forest carbon stock reversion cannot be assumed for so low period of time. One AC member confirms that reported values for regrowth are indeed usually quite low and do not even assume full regrowth of forests in 2100. One AC member mentions the database of Holly Gibbs that provides numbers for afforestation. However, it is pointed that afforestation brings higher carbon stock because it comes from an active land management, whereas abandoned land has a different dynamics. This is important because some alternative management of land could lead to higher rate of sequestration. Another AC member also points out that there were some blanks for the EU in that database and some care should be taken. Updated data could be certainly obtained. Overall AC mentions that this parameter is also uncertain and whatever value is used, it should be also subject to sensitivity analysis. IIASA suggests taking a simplified approach for a default value that will be varied with the sensitivity analysis.

4. Any Other Business

Modelling of livestock

- One AC member: Productivity is defined in GLOBIOM as level of output per feed intake but there are many other efficiency parameters in livestock production (calving rate, slaughter rate, etc.), not only the feed and the area that you need. It would be important to report these other parameters to understand evolution of productivity. Ecofys: Projections used in GLOBIOM indeed depend on all these parameters. IIASA: regional differences on these parameters are indeed implemented in the upstream models used, but it is more difficult to differentiate these across systems of a same region. Additionally, the model represents current systems observed today and no changes in these parameters are assumed currently. We look at the response of intensification along the feed intensification gradient only. AC member: why not using the number of cattle in each system to have a more precise characterisation of intensification. IIASA: this information can be provided from input and output parameters. For poultry, output per unit feed is the only intensification gradient. For cattle, there are two gradients: output per feed and output per ha. Reporting both would help for the understanding of the model output. Ecofys: we will make efforts to provide indicators in the report that are intuitive. AC member: meat per ha is a good indicator. IIASA agrees to report it.

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2. Inventory of suggested improvements to the GLOBIOM model (continued)

Note 1: The consortium gives priority for discussion in the plenary session to items classified as 'high priority'.

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- *Item 11 – Co-products.* One AC member notes that it is possible to do a simple substitution calculation for energy and protein, but this is a simplification of feed practices that may overstate substitution patterns, in particular for soybeans. In principle, a full least cost optimised assessment of livestock feed changes would be more attractive, but very time consuming and not worth the investment in this project. A 'middle' approach should be preferred. IIASA agrees, although such intermediary approach is not easy to define. In particular, the number of nutrients that should be accounted for, and the different incorporation constraints. One AC member notes that historical information is difficult to obtain because of the high diversity of farming practices. The simplified approach could be useful even if it overestimates the value of protein. The effective protein content of some co-products (taking into account quality) is however lower than the maximum attainable. Price paid by farmers for the feed ingredients reflect this reality, and protein content should be adjusted accordingly. This type of adjustment could be a simplified approach to represent the imperfect return of proteins. JRC has data on prices, although there could be some potential issue with public access as these are non-published yet. IIASA reminds that the current co-products conversion rates and substitution rates are based on values provided by the Gallagher review. Some AC members propose to send the consortium some published prices on oilseed meals that could help checking protein content. IIASA concludes that a flexible and pragmatic approach should be followed for this item. Some efforts will be devoted at improving the representation within the time available for this improvement. One AC member asks if US facilities will also be studied. IIASA confirms that the focus will be on the EU.
- *Item 15 – Crop-management.* Several AC members stress that there is no real interest to fully represent multi-cropping because it constitutes a complicated modelling challenge that would consume too much effort. However, the AC would like the consortium to propose a simpler solution to better take this issue into account, in particular in the baseline. One AC member points that if the dynamic response of yield is already high in the model, there is certainly no need to add multi-cropping effect. Indeed, literature on the yield response does not provide information on contribution of the different effects and the final yield response is already a good starting point. IIASA will document improvements performed and show in particular how the model behaves with respect to yield response. One member of the AC suggests that this topic would deserve some extra high priority because it impacts ILUC directly. In particular, IIASA could check if the dataset that are used includes the first and second crop on a parcel or only the first one. This might be different depending on the country. For instance, USDA presents first and second crop together for Brazil and assuming that the second crop is grown on new lands would be inconsistent.
- *Item 21 – Demand.* One AC member notes that the approach proposed for imperfect substitution works for liquid vegetable oils. For palm oil (solid), however, there should be a (fixed) additional handling cost. Another AC member also finds the approach reasonable but wonders how this would be calibrated. IIASA proposes as a first quick approach to rely on the modelling literature. A second approach would be to look at historical substitution patterns. A fixed cost could indeed be incorporated for the case of palm oil prices. Substitution should also be targeted by the sensitivity analysis. IIASA reminds that this substitution would be done in terms of tonnes in GLOBIOM. One AC member explains that some of the price differences also

reflect consumption habits and this introduce a lag in the substitution. Ecofys also mentions that FEDIOL offered to provide some data and inputs from their side could be valuable.

- *Item 24 – Region resolution.* One AC member reminds that conversion to cropland from forest had been remarkably high and this should be reflected in model results. If level of regional aggregation influences this result, this point should be addressed. IIASA explains that the level of aggregation discussed here is relative to economic market variables. Currently, Argentina is part of South America, and Indonesia and Malaysia are part of Southeast Asia. The resolution of the supply side would not change with this improvement but trade flows would be more precisely distributed to the different countries within the region. Production would then be reallocated to the different pixels on a suitability basis, starting from the country level results, instead of the results of the larger region. The general impression of the AC is that this improvement is important but not on the top of the priority list.
- *Item 26 – Infrastructure.* One AC member asks clarification on the type of infrastructure costs that would be here looked at. IIASA explains that international transportation costs are already represented, but the improvement indicated here relates to transport from each production unit to the local economic market. Ecofys expresses its scepticism with respect to the possibility of modelling these local transportation costs. Many transportation modes and local behaviour cannot be accurately represented. Several members within the AC agree. One AC member notes that the model starts with a calibration on the existing situation, which means production possibilities are already adjusted for transportation costs. This aspect does not seem as sensitive as some others in the current debate. AC members propose to assign a lower level of priority to this improvement.
- *Item 27 – Land availability.* One AC member indicates that characterisation of other types of land than those currently represented in the model is indeed important and should be subject to some research efforts. But the quality of the data remains limited to do a precise disaggregation. IIASA notes that this issue of land use data in fact relates to improvement 31 that was identified as a larger research topic going beyond the scope of this project. One AC member proposes to keep the current representation and instead to address the question of easier access into “marginal” land use types through sensitivity analyses.
- *Item 29 – Land use change.* IIASA explains that going for a simpler solution than an explicit modelling of palm oil plantation expansion appears more adequate for this project. Indeed, palm oil is not in the SPAM model used for allocating crops in the different pixels, and other sources would be needed to have a precise spatial allocation of this crop and suitability data. Second, expansion patterns may not follow some suitability criteria. One AC member indeed explains that peat lands are not the best lands for palm plantations but other drivers such as land ownership are very important. Some other AC members agree and support an approach based historic trends. One member however reminds that future expansion could be different from past trends (e.g. due to intensification). One AC member however notes that yields have in fact been relatively flat, and current efforts to replant might not do much more effect than resuming yield growth at a baseline rate. Another AC member observes that conversion of peat seems to become worse and worse, but there does not seem to be consensus on this trend within AC. One AC member points that production can still increase through optimised lifecycle of plantations. A study from E4tech discussed this possibility. However, another AC member reminds that there is currently no robust control to prevent further exploitation of peat land. AC members reach a final consensus that, in any case, the suitability approach is not appropriate. The consortium should investigate to what extent the future expansion can be different from past, and include a range of plausible expansion rates into peat lands in the sensitivity analysis. More discussion will be needed after a literature review is performed.
- *Item 31 – Land use change.* IIASA explains that this question of land cover and land use precision is critical. However, it is a real scientific challenge alone and cannot be adequately

addressed in the context of this project on biofuel effect. This improvement will remain a long term research topic for some other large scale projects.

- *Item 34 – Technologies.* IIASA explains that products to add could be for instance corn oil or glycerine. One AC member notes that currently, corn oil is only marginally produced in the EU (only one plant). If corn oil is added, it is important in that case to adjust the DDGS yield to take into account the nutrient extraction associated to it, and avoid double counting.

A tour de table was held to obtain the three highest priority improvements per AC member (see table below). The consortium aims to reflect the AC priorities in the Inventory document and Baseline and Scenarios document.

Improvements listed in top-3 of AC members	Nr of members who prioritised
1. Agricultural residues	1
7. Peat land emission factors	2
9. Natural vegetation regrowth	1
11. Co-product substitution in livestock sector	2
15. Multi-cropping	2
21. Vegetable oil substitution	2
22. Other product substitution	1
27. Unused agricultural land	3
29. Expansion of palm plantations into peat land	2
34. Crushing conversion factors	1

Generally, AC suggests that simple solutions be adopted in as many cases as possible to allow devoting more effort to only a few research items.

During the tour de table, one AC member also suggests that more time be spent on the land transition matrices, as those are determinant for the deforestation patterns. This investigation is key for a reliable modelling. For example, conversion from grassland to managed forest does not seem covered, whereas this is happening in some regions, such as Brazil, with expansion of Eucalyptus plantations. IIASA notes that this transition is represented in GLOBIOM with a different land use, short rotation plantations. One AC member proposes to provide support on this investigation.

One AC member comments on item 16 that IIASA could use a simple rule, such as having phosphorus and potash following the yield increase. IIASA confirms that this is what is currently assumed. These specifications are directly represented in the crop model for the initial yield in each management.

One AC member also notes that cross-price elasticities effects are important to consider. However, one scenario could be tested where demand do not respond to prices, to see what happens if consumption is kept constant in the shock.

3. Proposal for a modelling baseline, feedstock scenarios, policy scenarios and sensitivity analysis

- One AC member notes that both wheat and rye are included. It will be interesting to see the differences between these two shocks. The results from these two different scenarios should indeed not be very different, which constitutes a good test for the model.
- One AC member asks for some clarification on the wording used: does 'sensitivity analysis' mean change on only one parameter? IIASA explains that a Monte Carlo analysis is planned; therefore 'n' parameters will be changed at the same time. AC member reminds that for FAPRI, 500 runs were performed but some correlations across parameters were assumed. IIASA explains that a correlation matrix across products and regions could be possible for GLOBIOM too; this is still to be determined. With correlation, one should expect a larger range of results because cases where parameters can compensate for each other occur less frequently. Ecofys indicates that in terms of wording, one should rather refer to this investigation as an "uncertainty analysis". For a sensitivity analysis of individual parameters, indeed, Monte-Carlo is not really necessary, a few runs are sufficient to produce some informative tornado diagrams. One AC member points that clarification of definitions of 'baseline', 'scenarios', 'sensitivity', 'parameters', 'Monte Carlo', etc. would be much useful for future communications, in particular for stakeholders. For instance, does changing one feedstock (point change) represent a scenario? IIASA replies that this represents a scenario, because it is a policy shock. The Monte Carlo analysis is independent of the scenario. Monte-Carlo would be applied to several parameters for each scenario, and also for the baseline. A discussion follows on the effect of changing the scenario on the distribution of results, but without reaching a common view on the influence that different scenario assumption could have on results distribution. One AC member thinks that more effort should be devoted to scenarios than to Monte-Carlo. IFPRI distribution of results has indeed been little used in the policy debate. It is also not clear how useful tornado graphs would be for an economic analysis. Another AC member proposes to replace the Monte Carlo by calculations along the different dimensions of a matrix. IIASA however explains that for a large number of parameters, the dimension of such matrix would explode quickly. One AC member acknowledges that doing scenarios may appear more appealing than lots of efforts on sensitivity analysis; however, from the perspective of the stakeholders, sensitivity analysis is important to see the robustness of the results and avoid critics about "black box" modelling. One AC member finds that the Monte Carlo could offer interesting ways of presenting the results, for instance, inferring the probability of having a biofuel pathway saving x% of GHG emissions.
- One AC member asks how the different shocks on different feedstock will be normalised. It would be interesting to know if all shocks assume a similar level of biofuel or of feedstock consumption. IIASA explains that quantities of feedstock will be targeted to be then able to account for the different efficiencies of transformation pathways. Conversion rates are implemented directly in the model so targeting the feedstock or the biofuel leads to similar consistent outcomes. AC members indeed think it should not be an issue as acute as in CGEs that have more difficulties to convert values into quantities.
- One AC member asks if a scenario B is useful as scenario A already tests the different feedstocks effect; Ecofys: individual ILUC factors will be calculated from scenario A to compare with each pathway direct emissions. But scenario B is also interesting because the weighted sum of A may not equal B. Additionally, several scenarios B can be tested and compared. One AC member confirms that non-linear results could be anticipated and therefore supports this distinction between A and B.

A tour de table was held to allow AC members to share remaining comments or questions on the baseline and scenarios.

- One AC member suggests to add other possible scenarios and to drop the Monte Carlo to keep the same level of effort. A less deforestation scenario is important because governments of tropical regions will be forced to better enforce forest protection policies.
- Another AC member objects that, although Monte-Carlo runs can sometimes add only limited information, they are still valuable and should not be dropped. Sensitivities on MIRAGE results have been used in some publications and the work would be criticised if these explorations on sensitivity are not performed. Monte Carlo gives some symmetry in the results and reduces the risk of number cherry-picking. Proper uncertainty analysis with balanced scenarios would be optimal.
- One AC member also reminds that Brazilian sugar cane is not expanding currently in spite of the rise of demand for ethanol in the US and EU. Very little quantities are exported as the sector is not competitive anymore. This situation may persist in the future if market prices do not change and domestic growth remains limited. This should be reflected in the model. IIASA agrees but reminds that for bioenergy shocks, this will be represented exogenously in the model for bioenergy consumption. However, some increased exports will be included in the scenario A on the sugar cane feedstock because some quantities are needed to reach the target of that scenario. AC member notes that there is a risk that the work is criticised if too much ethanol is sourced from sugar cane in scenario B, as it would not reflect current market conditions.
- Several AC members find that the range over which historical yield are estimated for the yield projections (30 years) is too large. Going back to before 1990 seems dangerous because drivers of yield increase were different from today's. A shorter and more recent window such as 1998 – 2013 appears more appropriate. Some yield stagnation has also been observed for some crops and this should be reflected on.
- One AC member asks how feedstocks origin will be determined. There are big differences between US corn ethanol and EU corn ethanol sectors. IIASA replies that current tariff policies will be represented; therefore difference in production prices in the US may not play a strong role due to presence of an anti-dumping tariff that blocks import to EU of US ethanol.
- One AC member invites to reconsider the projections for US second generation. The official US EPA cellulosic ethanol targets are not realistic. Figures from the US Energy Information Agency (EIA) should be preferred for RFS targets.
- One AC member asks whether technology conversion rate grows at the same pace as crop yield. IIASA answers that technology rate is currently kept constant in the baseline but that this assumption will be revised if some information is received on this.
- One AC member asks about the annual GDP growth rate assumed in the SSP2 scenario. IIASA indicates it is around 2%.
- One AC member notes that marginal yield has not been discussed. IIASA explains that this is an endogenous parameter in the model. Discussion with stakeholders on this topic led to decision to report more transparently what would be the marginal yield in the different scenarios. AC member notes that there is a huge variation of yield within a NUTS 2 region and even between individual farms. Marginal yield is therefore much lower than average yield (65% lower for an individual farm, and therefore probably much lower for a whole new region, such as Romania). Sensitivity analysis should try to take this into account. The spread of wheat yields in the UK is 65% of the average (coincidentally the same figure). One AC member asks how yield potential is determined for non-croplands. IIASA explains that this is determined by EPIC, taking into account slope, elevation, soil and climate (but not current vegetation).
- One AC member explains that the 5% CAP, still being discussed, is probably not equivalent to a reduction of production by 5% (because not the highest productive land will be set aside). He

wonders how this could be represented in the model. IIASA explains that the current content of set-aside requirement will be examined and implemented in the baseline the most consistently as possible.

4. Any Other Business

Some general remarks from AC members:

- As there may be some focus on some particular regions, it is very important to be transparent and clear about which parameters will be changed for some specific situations and for what reason. The impact of these changes should also be shown for such cases.
- One AC member asks if the carbon balance is closed. It seems important to show a carbon flow diagram to illustrate how the model can fit into it.
- With respect to fertilizers, it seems perhaps too far-fetched to add P and K to intensification response. N is most important and should be investigated in details.
- Overall, the report will need to be very transparent on what changes have been done and why.