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30 October 2007

To Dr Rajendra Pachauri
Chairman, IPCC
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CH - 1211 Geneva 2,
Switzerland

by fax/email

Dear Dr Pachauri,

Concerns over notes on biofuels in IPCC AR4 Mitigation report and SPM

First of all, we note that climate change and the human contribution to it are most pressing issues that require the greatest attention.

We note further the important role the IPCC has played in demonstrating the strength of scientific agreement on various aspects of, and matters surrounding, climate change.

We also welcome, this year, the on-line pre-publication of the full draft AR4 Mitigation report plus corrections.

However, we consider that there are serious and dangerous deficiencies in the notes on biofuels both in the AR4 Mitigation SPM and Transport chapter in their present form; and further that inquiries as to the basis of a key claim made (**10** below) have not been responded to.

With accumulating evidence of multiple adverse consequences for emissions, humanity and biodiversity from unbridled biofuel expansion, we have grave concerns that the respective parts of IPCC publications will become used to justify further adverse developments, and delays in rescinding already erroneous decisions.

The following are our key concerns. Where recent published work has been referenced, the issues raised are not new to science.

1. Chapter 5 (Transport), p325 mentions that alternative fossil fuels will tend to lead to increased emissions. It should have been made clearer on this page that replacing petroleum fuels with electricity, hydrogen and biofuels all *also* carry risks of being environmentally counter-productive.

2. Chapter 5, p325 states that mitigation potential of biomass fuel is uncertain as it may be limited by its sustainability in "massive scale". On p344 it is elaborated that the "biofuel potential…is limited by the amount of available agricultural land" not required for other uses, and that "the production of biofuels on a massive scale may require deforestation and the release of soil carbon".

Although this may be strictly true in literal terms, the notes *omit* to state that in practice, even at a small scale, cultivation of biofuels often will take fertile land away from agricultural use, and thus lead to land-use change emissions, as the market-place encourages the world farming frontier to expand into forests and other often carbon-rich ecosystems to accommodate. This is currently leading variously to major damage to biodiversity, irregularities in land acquisition and other human rights abuses, water pollution and stress on water resources in addition to the land disturbance emissions.

For example, in Europe the use of rapeseed oil for biodiesel in Europe has led to increased palm oil imports to compensate[i], a principle recognized by palm oil producers[ii]. The growing world bioenergy-related market for palm oil is a major part of the speculative incentive for deforestation for new plantations around the tropics, with major attendant land-use change emissions from soils and often from vegetation[iii], as well as human displacement[iv], the slaughter of orang-utans and other losses of very considerable biodiversity.

The emissions associated with palm oil plantations on thick tropical peat are particularly colossal. A major recent study estimated that producing 1 tonne of palm oil on peatland emitted between 10 and 30 tonnes of CO2 from drainage decomposition, excluding fires associated with land clearance, which in South-East Asia's peatlands were currently emitting more than twice as much CO2 as that from drainage decomposition[v]. Peat swamp forests are the only major land area not yet populated in SE Asia. Increased demand for palm oil will accelerate the conversion of peat swamp forests into plantations and thus will accelerate the release of greenhouse gases and the destruction of biodiversity hotspots.

In the United States, increased maize plantings and their use for ethanol have contributed to price rises for many food commodities, forcing up the incentive for

deforestation to grow soya and other commodities in South America and elsewhere[vi]. Poignantly, 2007 has seen exceptionally severe fires in the soya-growing areas of South America. US maize plantings are also displacing virgin prairie with attendant carbon releases.

Forest displacement is reinforced when pastoralists and smallholders who have lost land to advancing monocultures move to forest edges to continue in such livelihoods[vii].

3. Chapter 5 cites an estimate of the expected savings from biofuel substitution: p326: "The use of current and advanced biofuels would give an additional reduction potential of another 600–1500 $MtCO_2$-eq in 2030 at costs <25 US$/$tCO_2$ *(low agreement, limited evidence).*" This is derived further in 5.4.2.3, pp. 365-366, based on the IEA report Energy Technology Perspectives 2006 and an overall estimate of a 25% CO_2-eq emissions saving from biofuel substitution.

Yet such an estimate does not make allowance for land-use change emissions, whether direct or indirect, from such an expansion of biofuels, which in many instances could take decades or centuries to recoup, as for example the Concawe study and this year's UN report on bioenergy have correctly noted[viii].

The danger, then of a major outlay of emissions and cumulative radiative forcing effects far exceeding the hypothetical mitigation from biofuels by 2030, should be noted by the IPCC, and highlighted prominently beside any projection of hypothetical gains.

It should further be mentioned that even if deforestation could somehow be halted, there is a major likelihood that the combined effects of the rising world dietary footprint (from diversifying diets and rising population) and more widespread crop failures and droughts associated with climate change will cause the scope to produce biomass or biofuel crops to *fall* by 2030, if not very much sooner.

4. Ch 5, pp343-344 admits that one reason for uncertainty in well-to-wheels emissions balance calculations is "how to handle the effects of alternative uses of land" and states "Typical examples are shown in Figure 5.10." Yet the examples in Figure 5.10 make *no* allowance for land-use change effects.

5. There is no mention of the key principle that for a given quantity of land, usually several times more emission mitigation (CO2-eq) per hectare can be achieved by either (a) growing solid biomass crops (tall grasses or short rotation coppice), or using agricultural surpluses or waste cut biomass, to replace coal, or (b) simply reafforesting the same land[ix], than biofuels for transport. These non-transport land-uses are likely to remain superior for mitigation for many years to come.[x]

For example, the Concawe Well-to-Wheels study[xi] reports that typical EU-based biofuel crops for transport will only yield 1/10 - 1/5 the emissions savings per hectare of biomass crops for stationary applications (compared with wood used for coal

replacement). Second generation ethanol (also based on wood) returned only 1/5 the emissions mitigation yield of using wood as a standard.

This point should be prominently made to policy-makers, who in announcing targets for biofuels for transport have prioritized that land-use OVER the above far greater emissions mitigation potentials, in addition to other issues (e.g. world food supply, water resources, conserving natural forests, grasslands and wetlands).

It is insufficient merely to mention, as Ch 5 does (p344) that biomass for stationary applications tends to deliver emissions savings at a lower price than biofuels for transport.

6. Ch 5, p344, notes that "The biofuel potential is limited by…The amount of available agricultural land (and in case of competing uses for that land) for traditional and dedicated energy crops;" followed by a reference to release of soil carbon.

This statement does not warn clearly enough of the seriousness of the danger of expanding the agricultural frontier, as stated in the Concawe Well-to-Wheels report:[viii] "We deliberately did not consider the expansion of arable area onto other land, notably pasture and forest. Apart from the societal resistance, such change in land use would be likely to release large amounts of carbon from the soil, negating any benefit of the energy crops for decades to come."

7. Ch 5, p342 notes "Cellulosic crops… may be grown in areas unsuitable for grains and other food/feed crops and thus do not compete with food." This is incorrect (whether or not the word "do" was intended), since such land is often used as pasture for livestock and is currently under stress in many locations[xii],

It continues: "the energy use is far less, resulting in much greater GHG reductions than with corn and most food crops". This is inaccurate since cellulosic ethanol involves more fermentation than conventional ethanol, and distillation as before[xi, xiii], although cellulosic ethanol may outperform conventional ethanol in some scenarios[xii].

In contrast, for example, the use of inefficient solar cells to recharge inefficient batteries in hybrid cars is at least 100 times more energy-efficient than any current land-use system for producing ethanol[xiii], and solar cells can be sited in desert.

8. Ch 5, p379, 5.5.5 notes that "implementation [of biofuels in the transport sector] would generally have positive social, environmental… side effects."

This is a highly contentious claim in view of the widespread conversion of biodiverse tropical forests and grasslands into biofuel monocultures, associated human rights abuses, pollution from fertilizer run-off and plant residue burning, and more widely, reactive nitrogen emissions and potential stresses on water supplies, soils and mineral fertilizer sources.

There are further dangers from biofuel crop plants acting as invasive species and from the escape of genetically modified higher yielding plants and organisms adapted for use in ligno-cellulosic technology.

The rise in world food prices[vi] increases food stress and hardship for the urban poor of the Global South, and is straining food aid budgets[xiv], though benefiting many farmers.

More intense land use tends to reduce local biodiversity[xv], and the spread of monocultures will overall impact negatively on tropical forests and other natural and semi-natural habitats, their resilience, ecosystem services such as nutrient cycling and climate moderation[xvi], and the conservation of species.

This is not to argue against all bioenergy, but present policies of the EU, US and elsewhere are leading to a huge range of adverse outcomes (see also **2)** and very poor resource stewardship (see also **5**) though involving considerable subsidy. There is surely scope for decision-makers to design a better fiscal regime for bioenergy.

In this context it will certainly not suffice to label or 'certify' some biofuels as 'sustainable', as has been suggested in Europe, on the basis of estimated emissions savings that do not take into account the displaced land-use change consequences if they are sourced from land that would otherwise have been used to produce food[xvii]

9. Ch 5 only refers to the Brazilian sugar-ethanol industry in glowing terms: p344: "the highly advanced state of Brazilian sugar farming and processing", and "The example of ethanol in Brazil is a model."

Such descriptions are ill-fitting in view of the widely reported areas of poor practice associated with the Brazilian sugar-cane industry including employee health and safety, smoke from ethanol industry; and the controversial expansion of sugar-cane into the Cerrado and development beside the Pantanal wetland (although a recent declaration of restriction on this is welcomed)[xviii].

Indeed, the Co-ordinating Lead Author Prof. S Kahn Ribeiro of the Federal University of Rio de Janeiro cannot be unaware of these issues.

Sugarcane production in Brazil also causes more soil erosion than any other crop grown in Brazil[xix]

10. The Summary for Policy Makers, table SPM.7, p20 refers to "biofuel blending" as a policy, measure or instrument "shown to be environmentally effective… in at least a number of national cases" - a Brazilian tabled amendment.

This claim is of extreme concern, since no justification for it appears elsewhere in the report, and, bearing in mind the issues set out above, we are unaware of the studies that can be used to justify such a claim. Furthermore, inquiries as to the basis for this claim were made to the Co-ordinating Lead Author Prof. S Kahn Ribeiro in May, and have not been replied to.

There should be no such non-transparency in public science. We call on you now to publish the basis for this claim or withdraw it.

If the analysis of the US ethanol programme by Farrell et al (2006)[xx] is being used in the basis, this paper makes no allowance for the resultant land-use change emissions (see **2.** above), and itself cautions:"several key issues remain unquantified, such as soil erosion and the conversion of forest to agriculture"; and other elements of its basis for estimating emissions savings are contested, see for example Patzek (2006)[xxi] and Crutzen et al. (2007)[xxii]. Earlier work has noted that corn production causes more soil erosion than any other crop grown in the US[xxiii].

In summary, many notes in the Mitigation report give the impression that biofuel expansion is generally a good way to proceed, with inadequate reference to the dangers and pitfalls; the SPM further claims that biofuel blending measures have had proven environmental benefit, yet the Co-ordinating Lead Author concerned has ignored inquiries as to the basis of this claim.

Sincerely,

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i FAO, "Biofuels and Commodity Markets – Palm Oil Focus", 2006 (http://www.fao.org/es/ESC/common/ecg/110542_en_full_paper_English.pdf): "EU palm oil imports have already doubled during the 2000-2006 period, mostly to substitute for rapeseed oil diverted from food to fuel uses."

See also "Vegetable Oils: Competition in a Changing Market", Agriculture and Agri-food Canada: 2005 (available on-line at http://www.agr.gc.ca/mad-dam/index_e.php?s1=pubs&s2=bi&s3=php&page=bulletin_18_11_2005-06-10): "the EU…is increasing imports [of palm oil] to offset the shortage of rape-oil in response to shortages caused by increased bio-fuel consumption."

ii Benjamin Low, "CPO Prices Seen Up In 06 As Biodiesel Fuels Demand" http://asia.news.yahoo.com/060224/5/2ge5t.html: "[palm oil] industry officials said it didn't matter whether palm oil was used in biodiesel production, because even if it isn't, it still stands to benefit from

the world's growing interest in alternative fuels…Even if it is another oil that is goes into biodiesel, that other oil then needs to be replaced. Either way, there's going to be a vacuum and palm oil can fill that vacuum - be it for biodiesel or for food," said Carl Bek-Nielsen, vice chairman of United Plantations Bhd, a major palm oil producer in Malaysia."

iii See for example "Carbon Sequestration and Trace Gas emissions in Slash-and-Burn and Alternative Land-Uses in the Humid Tropics", Final Report, Phase II, Palm et al, 2000, http://www.asb.cgiar.org/PDFwebdocs/climatechangephaseIIreport.pdf. Subsequent parts of the ASB Climate Change study found that the extent of carbon storage in mature forest roots had been underestimated.

iv Re. worldwide situation: "Biofuel crops threaten Indigenous people", AP, 15/5/07, http://www.hemscott.com/news/latest-news/item.do?newsId=42737072526895. Re. Colombia: "Massacres and paramilitary land seizures behind the biofuel revolution", The Guardian, 5 June 2007, http://environment.guardian.co.uk/energy/story/0,,2095349,00.html

v "Peat-CO2: Assessment of CO2 emissions from drained peatlands in South-east Asia.", Hooijer et al, 2006, available from Wetlands International, pp29-30. Estimated CO2 emissions from drained peatland in SE Asia were 632 Mt/y, excluding fire emissions of 1400 Mt/y. More recent study: "Land cover change 2002–2005 in Borneo and the role of fire derived from MODIS imagery." A Langner, J Miettinen and F . Siegert (2007). Global Change Biology (2007) 13, 1–12. Also significant in this context are the flux changes in N_2O and CH_4 (see for example Germer and Sauerborn, DOI 10.1007/s10668-006-9080-1) and the action of such forest as a carbon sink (see Boehm and Siegert, 1999, http://www.rhc.at/kalteng/pdf/kalteng_1999_Penang.pdf, p4).

vi FAO: "Food import bills reach a record high partly on soaring demand for biofuels", Food Outlook Global Market Analysis (http://www.fao.org/docrep/010/ah864e/ah864e00.htm); on land price rises in South America: "Farmland prices rise faster than some Manhattan and London apartments", International Herald Tribune, 2007, http://www.iht.com/articles/2007/02/19/bloomberg/bxland.php.

There is a compilation of data on the recent Amazon fires and the link to soya-growing areas in "2007 Amazon fires among worst ever", http://news.mongabay.com/2007/1021-amazon.html. On the recent Paraguay fires and link to crop planting: "Paraguay declares fire emergency" BBC News, 12/9/2007, http://news.bbc.co.uk/1/hi/world/americas/6992374.stm

vii: "Deforestation in Brazilian Amazonia: History, Rates and Consequences", Fearnside 2005, Conservation Biology 19: 3, http://www.geography.wisc.edu/classes/geog339/Fearnside%202005.pdf

viii "Well-to-Wheels Report" of "Well-to-Wheels analysis of future automotive fuels and powertrains in the European context", Concawe/Eucar/EC-JRC, download from http://ies.jrc.cec.eu.int/wtw.html. p76 states: "We deliberately did not consider the expansion of arable area onto other land, notably pasture and forest. Apart from the societal resistance, such change in land use would be likely to release large amounts of carbon from the soil, negating any benefit of the energy crops for decades to come."

UN Report: "Sustainable Energy: A Framework for Decision Makers", UN-Energy, May 2007.

ix A major recent assessment, "Carbon Mitigation by Biofuels or by Saving and Restoring Forests?", Righelato and Spracklen, 2007, DOI: 10.1126/science.1141361found that reafforestation of cropland achieved between 2x and 9x the emissions mitigation of biofuel crops over a 30 year window, in both tropical and temperate scenarios. *News agency coverage:* http://environment.newscientist.com/channel/earth/dn12496-forget-biofuels--burn-oil-and-plant-forests-instead.html Reafforestation projects can have adverse local impacts, e.g. on food sovereignty, rights of way, water quality.

x An important special case is enclosed or semi-enclosed systems for using land to grow algae with high oil content, using carbon dioxide exhaust from a power station, cement works etc. This would not

render the carbon dioxide source 'clean', but is a potentially helpful transitional technology if very high fuel yields can be achieved.

xi Well-to-Wheels Report (see viii), figure 9.2, p85. As this chart shows, the study found the net emissions mitigation yield of cellulosic ethanol from a woody crop to be similar to that of ethanol from wheat. Some alternative chemical pathways for powering vehicles using biomass achieved higher mitigation yields than ethanol or biodiesel options, but at a high cost.

xii "World's Rangelands Deteriorating Under Mounting Pressure", Brown, L.R., Earth Policy Institute, February 5, 2002, http://www.earth-policy.org/Updates/Update6.htm. The use of prairie grasses in US as an ethanol feedstock, for example (Tilman, D., J. Hill, C. Lehman, Science 314: 1598-1600. (2006), http://www.sciencemag.org/cgi/content/abstract/314/5805/1598), would be in competition with the many livestock supported by the prairies, although less damaging than ploughing them for maize.

xiii As shown most recently by Patzek, OECD paper, 2007, http://petroleum.berkeley.edu/papers/Biofuels/OECDSept102007TWPatzek.pdf (parts of which are Chapter 2, Ethanol Production from Cellulosics, in "Renewable Energy Systems: Environmental and Energetic Issues", Springer Verlag, 2007)), current cellulosic ethanol refineries are the least energy-efficient alternative to other options of producing liquid transportation fuels. This study finds that using inefficient solar cells to recharge inefficient batteries in hybrid cars is at least 100 times more energy-efficient than any current land-use system for producing ethanol. Based on US-based and tropical crop/solar cell comparisons; "land-use" not counting ethanol from mangrove palms.

xiv See for example "Food prices buoyed by biofuel affect aid", IRIN news, 13/9/2007, http://www.irinnews.org/Report.aspx?ReportId=74287

xv On negative correlation between species diversity and intensity of land -use, see for example Haberl et al., 2004. "Human appropriation of net primary production and species diversity in agricultural landscapes", Agriculture, Ecosystems and Environment 102 (2004) 213–218; Hoffmann et al., 2001. "Effects of patterning on biodiversity in northeast German agro-landscapes." In: Tenhunen, J.D., Lenz, R., Hantschel, R. (Eds.), Ecosystem Approaches to Landscape Management in Central Europe, Ecological Studies 147. Springer, Berlin, pp. 325–340; Zechmeister, H.G., Moser, D., 2001. "The influence of agricultural land-use intensity on bryophyte species richness." Biodiversity Conserv. 10, 1609–1625.

xvi See for example: "The Economic, Social and Ecological Value of Ecosystem Services: *A Literature Review*" Eftec, report for UK government, 2005, http://statistics.defra.gov.uk/esg/reports/ecosystem/mainrep.pdf

xvii The UK Low Carbon Vehicle Partnership has noted: "LowCVP members recognise the proposed C&S [carbon certification and sustainability] reporting does not manage indirect land-use changes or concerns regarding competition between crops for energy, food and other applications." Response to RTFO consultation, May 2007, accessed from http://www.lowcvp.org.uk/lowcvp-viewpoint/index.asp

The Concawe Well-to-Wheels report (see viii), p78, noted: "The import of oilseeds or vegetable oils for biodiesel production (or for replacing domestic oilseeds which are diverted to oilseed manufacture) raises major questions about sustainability. One…major source is palm oils from Malaysia and Indonesia: a rapid increase in demand could be met by unsustainable production on rainforest land. Sustainable certification could be considered as a solution, the EU importing only certified sustainable products. However, unless the scheme was adopted worldwide, sustainable exports to EU would simply be replaced by unsustainable production for other markets."

Unilever, while chair of the Roundtable on Sustainable Palm Oil made the following comments in their 2006 EU biofuel directive consultation response: "Deforestation, particularly in the case of palmoil and soybeans, could lead to… devastation of the last remaining rain forests in Borneo and the Amazon region. There will not be a sufficient quantity of sustainable vegetable oils available to cover the new demand from bio-fuels and the current consumption growth in the rest of the world (China, India etc)…

Sustainability certification for biofuel feedstock addresses (micro-)production circumstances only. The real sustainability issue of current biofuel use is that it leads to a (macro-) expansion of feedstock production. Certification will not change the fact that for each ton of oil that is made unavailable for traditional users an additional ton of oil needs to be grown elsewhere… Unilever is chair of the Roundtable for Sustainable Palm Oil (RSPO)". Accessed from: http://ec.europa.eu/energy/res/legislation/doc/biofuels/contributions/industry/unilever.pdf

xviii On working conditions: Brazil Workers See Ethanol's Dark Side, AP, 1/10/2007, http://www.forbes.com/feeds/ap/2007/10/01/ap4174430.html; Lula raps Europe campaign against Brazil biofuel, Reuters 9/7/07, www.reuters.com/article/latestCrisis/idUSL09896481; "Brazil's ethanol slaves", The Guardian, 9/3/2007; http://www.guardian.co.uk/brazil/story/0,,2029962,00.html; "Planting Sugarcane and Reaping Poverty and Eco-Degradation in Brazil", Brazzil, 7/3/2007, http://www.brazzil.com/content/view/9827/80/

On smoke pollution: Brazil Ethanol Industry Goes Green for the Money, Reuters 6/7/2007, http://www.planetark.com/dailynewsstory.cfm/newsid/42975/story.htm

On Cerrado encroachment: Ratter, J.A. and J.F. Ribeiro and S. Bridgewater. "The Brazilian Cerrado Vegetation and Threats to its Biodiversity." Annals of Botany (80: 223-230, 1997); Hogan, Daniel Joseph and Jose Marcos Pinto da Cunha and Roberto Luiz do Carmo. "Population Distribution and Environmental Change in Brazil's Center-West Region." University of Campinas Population Studies Center (2001): Cerrado and Pantanal: see Ramsar Convention Secretariat press release, 2/2/07, http://www.ramsar.org/wwd/7/wwd2007_rpts_germany_gnf.htm

xix "Temporal erosion-induced soil degradation and yield loss" _Sparovek, G. and E. Schung. 2001. Soil Science Society of America Journal .65: 1479-1486.

xx "Ethanol Can Contribute to Energy and Environmental Goals", Farrell et al, 2006, http://rael.berkeley.edu/EBAMM/FarrellEthanolScience012706.pdf

xxi "A First-Law Thermodynamic Analysis of the Corn-Ethanol Cycle", T. W. Patzek, Natural Resources Research, Vol. 15, No. 4, December 2006, http://petroleum.berkeley.edu/papers/Biofuels/NRRPaper2.pdf.

xxii "N_2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels", P. J. Crutzen, A. R. Mosier, K. A. Smith, and W. Winiwarter, Atmos. Chem. Phys. Discuss., 7, 11191-11205, 2007 http://www.cosis.net/members/journals/df/article.php?paper=acpd-7-11191 *News agency coverage:* http://www.timesonline.co.uk/tol/news/uk/science/article2507851.ece

xxiii "Frontiers in Agricultural Research: Food, Health, Environment, and Communities," National Academies of Science. 2003. Washington D.C., National Academies of Science. 268pp.