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Health and environmental issues of palm oil

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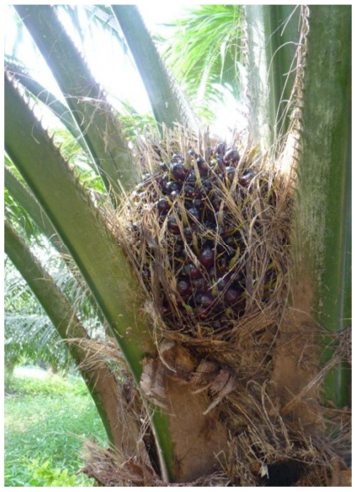

Summary

- *The very high profitability of oil palm combined with its intrinsic qualities and a massive and growing demand for food, as well as geographically concentrated cultivation conditions, leads to a definite impact on deforestation in producer countries, which is difficult to quantify precisely. While the past is irreversible, the future of primary forests is threatened by increased global demand for palm oil due to its recent use in first generation biofuels.*
- *In terms of health, its use in food may, in certain cases, present a risk because of its high palmitic acid content and its frequent presence in processed food products, while real levels of consumption are unknown. Its use in cosmetics does not present any particular risk.*
- *Certification is necessary to trace the origin, but with regard to European requirements, it faces uncertainties concerning the definition of the criteria qualifying the importance of the impact on the indirect change of land use.*

The context of this briefing

Palm oil is present in France in consumer products, food and cosmetics. It is used in some fuels (biodiesel). The product of a global agro-industrial chain, its demand is growing dramatically. Its frequent and growing presence in processed food and cosmetics, albeit in small quantities but without clear labelling to quantify it, raises the question of its effects on health, while its mode of production, which impacts biodiversity and carbon capture, is attracting particular attention from consumers, industry and policy makers (1), especially with regard to the challenges of deforestation, as recalled by a recent NGO report (2) and the 2018-2030 government plan to fight against imported deforestation (3).

The product and its utilisation

Palm oil is a vegetable oil extracted from the **pulp of the oil palm fruit** (4) and must be distinguished from **palm kernel oil**, which is extracted from the core of the same fruit. This pressed pulp produces 99% of oil (5) hence the low interest of oilcakes, compacted vegetable residues rich in proteins, used for soybean or rapeseed, in animal feed. Palm oil is a vegetable fat at room temperature, plastic and manipulable, stable during cooking and non-oxidizing (6). Its **physical, rheological and chemical properties** are at the root of its success in the agri-food industry, which is its largest global market. It is also used to a lesser extent in cosmetics and has more recently been incorporated into biofuels. According to a 2016 WWF study, 68% of the world's palm oil production goes to the food sector, 27% to industrial uses (cosmetics, detergents, cleaning products) and 5% to biofuels (7). Global

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production (8) of biofuels has globally experienced strong growth, by 37% between 2010 (59 MTep (9)) and 2017 (81 MTep). In 2015, the largest consumers of palm oil were India and Indonesia, followed by the European Union and China (10).

■ Its composition and physiological effects

Palm oil is composed (11) mainly of **palmitic acid** (43.5%), a long-chain saturated fatty acid which is atherogenic in case of excess (12) — as are two other saturated fatty acids, lauric (oil coconut) and myristic (butter and cream) (13) — **oleic acid** (36.6%), monounsaturated fatty acid predominent in our diet, and, to a lesser extent, **linoleic acid** (9%), a polyunsaturated fatty acid precursor of the omega 6 family of so-called essential fatty acids (14).

The **food use of palm oil**, the micronutrients of which are partly eliminated by refining, is of little relevance from a nutritional point of view, even harmful to health if, because of its palmitic acid content, its consumption contributes to exceeding the recommended upper limit of 8% of total energy intake (15), which is difficult to calculate in everyday life, given the lack of data on the consumption of processed foods and the amount of palmitic oil actually consumed.

In **cosmetology**, palm oil has been used in moisturising creams and hygiene products for almost 40 years because of its stability, olfactory neutrality and safety. Indeed, its lipids naturally present in the stratum corneum, like cholesterols or ceramides, are non-comedogenic at low doses used (16) and remain in the upper layers of the epidermis without entering the body.

■ Its utilisation in biofuels

The third use of palm oil results from its transformation into diesel biofuel (known as biodiesel) mixes with commercial diesel fuel up to a maximum volume of 8% (17). Two processes exist: **transesterification of oils**, which produces **FAME** (18) (fatty acids methyl esters), and more recently **hydrotreatment**, which produces **HVO** (Hydrotreated Vegetable Oil) **biodiesel**, with the latter process requiring much more expensive production units. On the basis of 2015 data(19), the FAME process used rapeseed (82.3%), palm oil (13.7%) or soybean (2.3%) as raw material, 78% of which came from Europe. While the energy performance is the same regardless of the raw material, the carbon footprint of the entire production chain (production + distribution) differs with a reduction of GHG emissions compared to traditional fuels of 38% for rapeseed, 31% for soya, and 19% for palm oil (20).

■ Its cultivation and cycle

The oil palm is a **perennial plant** whose culture (elaeiculture) is spreading in **humid tropical zones**, in a restricted geographical zone around the equator, where it finds the conditions of hygrometry (200 mm of rain per month (21)) and sunshine necessary (22) for the continuous production throughout the year of bunches of about 2 000 fruits (23). Its **economic life cycle** is **around 25 years long** (24) (25) with production beginning in the 3rd year, and full photosynthetic maturity being reached after 5 to 6 years (26).

Its **yields** are very high: **3.8 tonnes of oil per hectare** (t/ha) per year on average worldwide and a potential of more than 10 t/ha (27). This average is much higher than the yields of soybeans (0.4 t/ha/year), sunflower (0.55) and rapeseed (0.72), and explains the major part that palm oil represents in the total production of vegetable oils (28). These high yields make it possible to increase the volume produced in a given cultivated area, or to reduce the area cultivated for a fixed oil production. Beyond this, the quest for improved yields mainly involves research on cultural practices such as that conducted by the Center for International Cooperation in Agronomic Research for Development (CIRAD) and achieves **an average increase of 1% per year** (29). Genetic modification techniques are currently excluded, due in particular to the complexity of the oil palm genome and the multiple gene populations involved.

Cultivated areas are concentrated in Malaysia and Indonesia, which provided 85% of world production in 2018 (30) while some 40 other countries produce the remaining 15% (31). They doubled between 2000 and 2017 to 18.7 million hectares, equivalent to 34% of the area of mainland France (32) and 6.6% of the world's oilseed area (33). Yields and surfaces produced 59 million tonnes of palm oil worldwide in 2016 (34) and nearly 63 million tonnes in 2017 (35) (+ 6.7%) or 38.7% of total world production of oil plants.

■ Its production and use

After harvest (every 10 to 14 days), the fruits must be pressed within 24 hours (36), which requires **the organisation of harvesting tanks centred around extraction plants.** With regard to **plant protection products and other inputs,** the **requirements for elaeiculture** are considered to be **lower than those for other oilseed crops** (37) with an observed herbicide consumption of 0.41 kg/ha/year for oil palm as against 4.2 kg/ha/year for soybean (38). Rational "zero waste" fertilisation is possible, which converts the liquid effluent of plants, the empty fruit bunches, the few cakes recovered after pressing and the leaves fallen to the ground (39) and thus avoids methanisation. However, in Indonesia and Malaysia, paraquat is said to be used, despite its ban in the European Union because of the serious toxicological risks (40) that it presents when handled.

Oil palm cultivation is generally **an intensive monoculture** where 60% of farms are agro-industrial complexes (of over 50 hectares) and 40% are small farmers whose profile is very heterogeneous (41), ranging from independent farmers linked to one or more cooperatives, to affiliates of a company managing their plantation. This diversity of models must be taken into account when analysing the social and societal impacts of palm oil production (42) (see below).

The decrease in average yields (43) of existing plantations observed between 2010 and 2014 in Indonesia (minus 6%) and in Malaysia (minus 26%), is apparently linked to the natural ageing of the palms. This suggests that the concomitant increase in production is mainly due to the increase in area dedicated to elaeiculture: an additional 7 million hectares in South-East Asia between 2000 and 2014 (44). The question then is the origin of the additional land allocated to this crop: does it come from deforestation of primary forest, use of degraded forests, peat bogs or non-forest agricultural areas?

■ How can deforestation be measured?

The main source of data on deforestation (45) is the Food and Agriculture Organization of the United Nations (FAO), which regularly publishes global forest resource assessment reports, detailing for each country (46) the state of forests and woodlands on the basis of standardised data provided by each country. This method has limitations due to its **declarative administrative approach** (47).

The other source is that of the NGO Global Forest Watch, with a **satellite monitoring** program of the state of the world's forests which, via the World Resources Institute (48), exploits the aerial photographs of the surface areas by analysing them using an algorithm to deduce the global vegetation cover. This approach also has limitations (49).

Field observation is a third way, at the local level, by making it possible to draw up the history of soil evolution and to estimate the role played by elaeiculture. Such work (50), while requiring more resources, will eventually be able to model the evolution of agro-systems.

■ What is the connection between elaeiculture and deforestation?

Oil palm is exploited either in wild palm groves, or with other crops on land cleared by burning, or in intensive monoculture on previously agricultural land (51). Quantification of the direct link between palm cultivation and deforestation is difficult, especially since the main reason for the loss of primary forest is the exploitation of timber and the mining that degrades it into fallow, savannah or agricultural land (52) on which the palm groves can later be installed. In the case of Indonesia, the proportion of direct and indirect deforestation linked to the expansion of elaeiculture is estimated between 11% (2000 to 2010) and 16% (1990 to 2005) (53) (54). At the same time, in 2016, 45% of oil palm plantations in that country were on lands that had been forests in 1989 (55).

In any case, while precise quantitative estimates differ (56), their **general meaning is unambiguous.** According to IUCN, if only 0.5% (57) of deforestation can be attributed directly to palm oil worldwide between 2000 and 2013 (58), this share is much higher in some tropical regions as illustrated by the data previously cited and is worsening on new fronts, as in Borneo where, from 1989 to 2008, nearly 30% of the primary forests felled were converted into oil palm plantations(59).

■ The impact of elaeiculture: indirect changes in soil use

The conversion of one hectare of palms for food into one hectare for biofuels does not increase "net deforestation", especially since the same oil is sometimes used in both cases. But in fact, the strong demand for biofuel oil pushes **producers of palm oil for food** (for which global demand is mostly rigid, outside Europe (60)) to **turn to new surfaces such** as degraded forests, peat bogs or primary forests. Although difficult to measure and controversial, the notion of indirect land-use change (ILUC) will be taken into account by the European Union in its energy policy (61).

Pointing out the perverse effects of biofuel certification, two public reports, "Mirage (62)" and "Globiom (69)", have developed methods for quantifying the influence of the ILUC on their final carbon impact. The European Parliament, the Commission and the Council agreed on 14 June 2018 (as part of the reform of renewable energy regulation) on the **cap on the consumption of "high-impact ILUC" biofuels** (63) **up to the end of 2023** at the level recorded in 2019 and **their gradual decline until their definitive elimination in 2030 (64), thus calling into question the production of biofuels from food biomass, including palm oil**. This decision is also in response to the prospects of increasing use of biofuels for air transport.

■ The carbon balance of elaeiculture

While European regulation provides for taking into account the concept of ILUC in the short term, the criteria of evaluation of its impact, weak, moderate or severe, are difficult to settle (65) and will have to take account of the latest available scientific data. The **total life cycle assessment** of palm oil production measured in grams of CO_2 per megajoule of biodiesel consumed is 40 on average, compared to only 9 for a culture without ILUC, but 400 if the palm grove has replaced a peat bog (66). Full life cycle assessments, however, vary in the studies depending on the

method used to measure the carbon load of the biomass and according to the selected hypothesis of plantation lifecycle.
The contribution of elaeiculture to global warming also depends on other factors such as liquid discharges (effluents), which are a source of methane during their fermentation (67). Effluent treatment is, however, widespread in industrial plantations, by cogeneration (combustion of waste to produce energy), composting and anaerobic digestion (68).
Finally, more complete analysis of the above-mentioned land use (69) shows, as part of the methodology followed, that the **net CO_2 emissions** for biodiesel using palm oil appear **significantly higher** than for those using soybean or sunflower oil, or as bio-fuels incorporating ethanol. Biofuel technologies of the second generation (from residual biomass, such as forest waste) and third generation (from algae), have a much better record. The third generation, however, has not yet reached the maturity necessary for its large-scale exploitation.

■ Impact on biodiversity

The regions in which elaeiculture flourishes are home to the Earth's most biodiverse forests (70). And in this tropical zone, it is well established that the conversion of forest areas to agricultural land is responsible for a significant decline in the variety of species (71). Monocultures, such as oil palm, affect the habitat of large **mammals whose diversity has decreased by between 65% and 90%** (72). In the same way, the diversity of birds, butterflies and fungi in a palm grove is only a fraction of that of a forest, whether primary or exploited (73). The IUCN (International Union for the Conservation of Nature) believes that on its list of 'critically endangered', 'endangered' or 'vulnerable' species, aquaculture and agriculture are the first causal factors (ahead of fishing and hunting), threatening 9,251 species. Palm oil would threaten 193 species on this same list.

■ Elaeiculture and development

The societal impact of the development of elaeiculture is complex, varying with location, time and populations (74) and more complete analysis would require further work. It should be noted here that on the one hand, field observation shows that the unquestionable increase in income made possible by elaeiculture does not benefit all concerned (75) and, on the other hand, that better respect for the human rights of communities and the establishment of legally secure land ownership in the concerned areas is often associated with more positive effects on the forest (76).

■ Labeling and traceability

Tracing and certifying palm oil is an indispensable tool for measuring and containing its impact. The RSPO ("Roundtable on Sustainable Palm Oil") label was created in 2004 on the initiative of industrial producers and NGOs (including the WWF) (77) and aims to be multipartite and **voluntary**. Specification establishes criteria that certified producers must respect. To date, 20% of global production is RSPO certified (78). This label has several levels of very different traceability requirements (RSPO Next is the highest(79)), but its favorable effects are gradual (80) and are the target of recurrent criticism (81).
Other certification schemes also exist: national certifications of producing States (82), certification of palm oil imported into Europe for biofuels (83), labelling of products using palm oil themselves (84).

■ Conclusions

Several recommendations can be made: in the **food sector**, collection of data on the **consumption of processed products** to assess whether or not there is a need to change the **labelling "vegetable oil"** to the stipulation of palmitic acid content; on an **environmental** level, regular assessment of the **qualitative and quantitative progress of certification on traceability**, and encouragement of projects for tools giving accurate and real-time knowledge of **deforestation** in order to better contain it; and finally, for transportation use, development of comprehensive life-cycle calculations for various biofuels and **support for initiatives in favour of second- and third-generation biofuels.**

Site Internet de l'OPECST :
http://www.assemblee-nationale.fr/commissions/opecst-index.asp
http://www.senat.fr/opecst/

Endnotes

1. On several occasions (2012, 2014 and 2016), French parliamentarians proposed the introduction of a specific tax on palm oil. Thus amendment No. 367 to the draft bill "Reconquest of Biodiversity, Nature and Landscapes", tabled in the Senate on 14 January 2016 by Ms. ARCHIMBAUD, Mr. GATTOLIN, Mrs. BLANDIN, Mr. DANTEC, Mr. LABBÉ and members of the ecologist group.
https://www.senat.fr/enseance/2014-2015/608/Amdt_367.html
Very recently, on November 16, the National Assembly passed, in first reading of the draft budget law for 2019, an amendment II-2267 to its article 60, tending, starting from 2021, to exclude fuels incorporating palm oil in the biofuel category and therefore their tax advantage as for the General Tax on Polluting Activities (TGAP).
http://www.assemblee-nationale.fr/15/amendements/1255C/AN/2267.asp

2. https://www.wwf.fr/sites/default/files/doc-2018-11/20181107_Rapport_Synthe%CC%80se_De%CC%81forestation_Importe%CC%81e_France_WWF-min.pdf
This recent WWF (World Wide Fund for Nature) report on the use of soybean, palm oil, cocoa, beef and leather, wood, pulp and rubber, concludes that on a footprint of France linked to imports of the seven imported agricultural and forestry raw materials identified of 14.8 million hectares (more than a quarter of the surface area of metropolitan France and half of the French agricultural area), palm oil accounts for 2.8%, 12 times less than soybean, which accounts for one third. This report recommends that governments prohibit first-generation biofuels resulting in significant indirect land-use changes (ILUC); encourage zero public procurement deforestation; stop the stigmatisation of palm oil while being rigorous on the modes of production. For this, strong technical and diplomatic partnerships need to be forged with producing countries.

3. https://www.ecologique-solidaire.gouv.fr/france-veut-mettre-fin-dici-2030-deforestation-causee-limportation-produits-non-durables-0

4. Elaeis guineensis: elais of Guinea. The oil palm is native to tropical Africa. MALEY J., BAHUCHET S. & al, (1999), "L'expansion du palmier à huile (Elaeis guineensis) en Afrique centrale au cours des trois derniers millénaires : nouvelles données et interprétations" ["The expansion of the oil palm (Elaeis guineensis) in Central Africa over the last three millennia: new data and interpretations"] [archive] - ecologie-humaine.eu; PDF, 20pp

5. MEIJAARD E., GARCIA-ULLOA J., SHEIL D., CARLSON K.M., WICH S.A., JUFFE-BIGNOLI D. and BROOKS T.M. (2018). "Palmiers à huile et biodiversité. Analyse de la situation" ["Oil palm and biodiversity. Situation Analysis"] by the IUCN Working Group on Oil Palm Gland, Switzerland: IUCN. p.9.

6. Fonds français alimentation et santé, « L'huile de palme : aspects nutritionnels, sociaux et environnementaux » ["Palm oil: nutritional, social and environmental aspects"] Available on: http://alimentation-sante.org/wp-content/uploads/2012/11/Presentation_Hd-P_1112.pdf

7. *Palm oil report Germany, Searching for alternatives*, wwf, 2016.

https://mobil.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF_Report_Palm_Oil_-_Searching_for_Alternatives.pdf

8. Data from the International Energy Agency https://www.iea.org/tcep/transport/biofuels/

9. MTep: million tons oil equivalent.

10. Report for the European Commission: "Environmental impact of palm oil consumption". 2018.

11. Ciqual, Table of nutritional composition by Anses: https://ciqual.anses.fr/#/aliments/16150/uile-de-palme-raffinee.

12. Some meta-analysis, however, tend to qualify this risk, e.g. "Meta-analysis of prospective cohort studies evaluating the association of saturated fat with cardiovascular disease," SIRI-TARINO PW, SUN Q., HU FB, KRAUSS RM, The American Journal of Clinical Nutrition 91 (3), 535-546, 2010 .
13. Anses, collective expertise report « Actualisation des apports nutritionnels conseillés pour les acides gras » ["Update of the recommended dietary intakes for fatty acids"], May 2011. p. 252. Accessible on:
https://www.anses.fr/fr/system/files/NUT2006sa0359Ra.pdf

14. An essential fatty acid is a fatty acid that the body needs but cannot synthesise.

15. ANSES estimates that the physiological need for fatty acids is 30% of the total energy intake with a maximum of 12% of saturated fatty acids but only 8% for three saturated fatty acids, in this case: palmitic, myristic and lauric acids, which are atherogenic in case of excess.
ANSES - collective expertise report « Actualisation des apports nutritionnels conseillés pour les acides gras » ["Update of the recommended dietary intakes for fatty acids"], May 2011. p. 252. Accessible on https://www.anses.fr/fr/system/files/NUT2006sa0359Ra.pdf

16. Comedones are accumulations of excess sebum which clogs the pores of the skin, preventing it from breathing.

17. Are liable to the tax provided for in Article 266 *quindecies* of the Customs Code, i.e. the supplement of general tax on polluting activities relating to fuels (TGAP-b), those who offer for consumption, in France, petroleum products which do not reach a target rate of incorporation of biofuels currently of 7.5% for the gasoline sector and 7.7% in the diesel sector. The differentiation of excise duties to take account of the incorporation of biofuels has been authorised by European legislation since 2002. Similar mechanisms exist in many other EU countries, but without harmonisation.

http://www.douane.gouv.fr/informations/bulletins-officiels-des-douanes?da=17-036
This provision was challenged, with regard to the use of palm oil in biofuels, during the discussion of the first part of the draft budget law for 2019 in the National Assembly, on October 16, 2018. Then, on November 16, the National Assembly adopted, in first reading of the Finance draft Bill for 2019, an amendment tending, starting from 2021, to exclude fuels incorporating palm oil from the category of biofuels and therefore their tax advantage as for the General Tax on Polluting Activities (TGAP) (see note (1)).
Moreover, the FAMEs are used as a mixture in commercially available commercial diesel at a maximum of 8% by volume. FAMEs can also be incorporated up to 30% by volume for off-trade use in "captive fleets".
Source Ministry of Ecological Transition in Solidarity https://www.ecologique-solidaire.gouv.fr/biofuels.

18. See the thesis by Berna HAMAD, which explains the whole process: « Transestérification des huiles végétales par l'éthanol en conditions douces par catalyses hétérogènes acide et basique ».["Transesterification of vegetable oils by ethanol under mild conditions by heterogeneous acid and basic catalysts"] Claude Bernard University - Lyon I, 2009
https://tel.archives-ouvertes.fr/tel-00675661/document

19. Data from the Ministry of Ecological Transition in Solidarity;
https://www.ecologique-solidaire.gouv.fr/biocarburants#e1

20. Annex V to Directive 2009/28 / EC of the European Parliament and of the Council of 23 April 2009 https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=OJ:L:2009:140:FULL&from=FR

21. Report for the European Commission. "Environmental impact of palm oil consumption" 2018.

22. BASRI WAHID M., ABDULLAH S., Henson I.E., "Oil palm – Achievements and potential". Plant Production Science 8, 288-297 (2005).

23. ONG Ch et al, "Comparison of palm oil, jatropha curcas and callophylum inophyllum for biodiesel : a review". *Renewable and Sustainable Energies Review*, 2011

24. MEIJAARD E. et al. TM Publishers (2018), « Palmiers à huile et biodiversité. Analyse de la situation » ["Oil Palm and Biodiversity. Situation Analysis"] by the IUCN Working Group on Oil Palm. Gland, Switzerland: IUCN.xv + 128p.

25. A. ISMAIL, M. NOOR MAMAT, "The Optimal Age of Oil Palm Replanting", *Oil Palm Industry Economic Journal* (vol 2(1)/2002). http://palmoilis.mpob.gov.my/publications/OPIEJ/opiejv2n1-2.pdf

26. BASRI WAHID M., ABDULLAH S., Henson I.E., "Oil palm – Achievements and potential". Plant Production Science 8, 288-297 (2005)

27. Alain RIVAL, « Palmier à huile : défis et questions pour la recherche » ["Oil palm: challenges and questions for research"]. *OCL* (20) n° 83 mai-juin 2013, p. 136
https://www.ocl-journal.org/articles/ocl/full_html/2013/03/ocl2013203p133/ocl2013203p133.html
28. *Oil World Database* and the CGEDD/CGAAER report (7% as against 39% in 2011) – *cf.* the list of people consulted.

29. DURAND-GASSELIN T., COCHARD B., AMBLARD P., DE FRANQUEVILLE H. « Un regard sur quarante ans d'amélioration génétique du palmier à huile (*Elaeis guineensis*) et son impact sur la filière » ["A look at 40 years of genetic improvement of the oil palm (Elaeis guineensis) and its impact on the sector"]. Le sélectionneur français 2002 ; 53 : 133-47. Quoted by Alain RIVAL, *Ibid.* p. 10

30. Data from the USDA: https://apps.fas.usda.gov/psdonline/circulars/oilseeds.pdf

31. Source theoilpalm.org

32. *Ibid.* MEIJAARD E. et al. TM Publishers (2018), « Palmiers à huile et biodiversité. Analyse de la situation » ["Oil Palm and Biodiversity. Situation Analysis"] by the IUCN Working Group on Oil Palm. Gland, Switzerland: IUCN.xv + 128p.

33. The most reliable data, recognised by all the actors concerning palm oil production volumes, are those of Oil World, cited here by the European Palm Oil Alliance
https://www.palmoilandfood.eu/fr/la-production-d%E2%80%99huile-de-palme

34. Data from *Palm Oil Analytics* http://www.palmoilanalytics.com/files/epos-final-59.pdf

35. WUDAN Y. "A makeover for the world's most hated crop". *Nature* 2017, 543 : 306-308.

36. MEIJAARD E. et al. TM Publishers (2018), « Palmiers à huile et biodiversité. Analyse de la situation » ["Oil Palm and Biodiversity. Situation Analysis"] by the IUCN Working Group on Oil Palm. Gland, Switzerland: IUCN.xv + 128p.

37. General Comment No. 6 of the European Parliament's motion for a resolution - 20 March 2017 on palm oil and deforestation of tropical moist forests (2016/2222 (INI) - Committee on the Environment, Public Health and Food Safety. Rapporteur: Kateřina KONEČNÁ.
http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-%2f%2fEP%2f%2fTEXT%2bREPORT%2bA8-2017-0066%2b0%2bDOC%2bXML%2bV0%2f%2fFR&language=FR

38. RIVAL A., LEVANG P. La palme des controverses [The "palm" of controversy], Qae Editions, 2013, 38-49.

39. BASRI WAHID M., ABDULLAH S., HENSON I.E. , "*Oil palm – Achievements and potential*". *Plant Production Science* 8, 288-297 (2005)

40. PETIT-PAITEL A, « Toxicité de l'herbicide paraquat : mécanismes moléculaires impliqués dans la dégénérescence neuronale parkinsonienne et potentiel thérapeutique d'une molécule anti-inflammatoire » ["Paraquat Herbicide Toxicity: Molecular Mechanisms Involved in Parkinsonian Neuronal Degeneration and the Therapeutic Potential of an Anti-inflammatory Molecule"]

. https://bvs.anses.fr/sites/default/files/BVS-mg-025-Petit-Paitel.pdf

41. RIVAL A., LEVANG P. "La palme des controverses" [The "palm" of controversy], Qae Editions, 2013, 38-49.

42. MEIJAARD E. et al. TM Publishers (2018), « Palmiers à huile et biodiversité. Analyse de la situation » ["Oil Palm and Biodiversity. Situation Analysis"] by the IUCN Working Group on Oil Palm. Gland, Switzerland: IUCN.xv + 128p.

43. MALINS C., 2012. "*Comments of the ICCT on EPA Palm Oil Pathway*" *NODA*. Washington, D.C. The author relies in this study on data from the USDA over the period 1970-2010.
https://www.theicct.org/sites/default/files/ICCT_EPA-palm-NODA-comments_Apr2012.pdf

44. MALINS C. (2017). "Driving deforestation : the impact of expanding palm oil demand through biofuel policy". Cerulogu, London.

45. Woodlands are traditionally classified according to their state: primary forests (which have never been modified by humans); secondary forests (modified primary forests which have reconstituted themselves more or less partially); peat soils (biomass accumulation zones in anaerobic environment) or degraded forests (part of the tree mass has disappeared, without affecting the total area). Each institution (government, FAO, NGO, etc.) which plans to evaluate the use of surfaces tends to adopt its own classification criteria.

46. List of Forest Resources Assessment (FRA) by country:
http://www.fao.org/forest-resources-assessment/current-assessment/country-reports/en

47. These limitations are due in particular to the incompleteness of data produced by some States, which affects the credibility of aggregate estimates. In addition, natural phenomena, such as fires or hurricanes, are not taken into account because the data required by FAO relates only to deliberate changes in land use.

48. GFW site: https://www.globalforestwatch.org/map

49. This method makes it difficult to distinguish the nature of forests because of the similar aspect as seen from the air. In addition, satellite observations cannot account for the temporary or permanent nature of deforestation. In addition, a photograph without historical information of land-use change can lead to unproven cause-and-effect relationships. The replacement of a forest with a palm or rubber plantation does not necessarily mean that this forest has been cut down to allow the establishment of a plantation. Forests are most often cut for logging and then replaced (or not) by farms.

50. See, for example, the observation of data on Kalimantan Island and the modelling of the evolution of forest cover according to different scenarios: SHARMA SK, BARAL H, PACHECO P and LAUMONIER Y, "Assessing impacts on ecosystem services under various plausible palm oil expansion scenarios in Central Kalimantan, Indonesia", *Cifor Brief Info* No. 176, May 2017, and a study on the island of Borneo: GAVEAU D L A et al.,"Rapid conversions and avoided deforestation: examining four decades of industrial plantation expansion in Borneo ". *Scientific Reports* 6, 32017 (2016) https://doi.org/10.1038/srep32017

51. RIVAL A., LEVANG P. La palme des controverses [The "palm" of controversy], Qae Editions, 2013, 38-49.

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56. These two approaches are also based on different values of the afforestation rate of an observation unit (0.5 hectare) required to qualify the forest area: respectively 10% and 30%. In addition, they are both confronted with the fact that the causes of deforestation vary significantly from one region to another.

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63. The definition of the concept of "strong impact ILUC" is the responsibility of the European Commission, whose recommendations in this area are expected on 1 February 2019 after the publication of a report in January 2019.

64. See the text N ° 2016/0382 (COD) adopted at first reading by the European Parliament in January 2018 to amend Directive 2009/28 / EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy produced from renewable sources https://oeilm.secure.europarl.europa.eu/oeil-mobile/summary/1519347?t=d&l=en, and especially the agreement registered by the Council on 27 June 2018 http://www.europarl.europa.eu/RegData/commissions/itre/lcag/2018/06-27/ITRE_LA(2018)005598_EN.pdf, which gave rise to a vote in plenary at European Parliament on 13 November 2018, with adoption of a motion for a legislative resolution on the proposal for a directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast) (COM) (2016) 0767 - C8-0500 / 2016 - 2016/0382 (COD)): http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P8-TA-2018-0444&format=XML&language=FR.

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77. Seven categories of actors are involved: manufacturers of consumer products (802 members, 46%), oil processors and traders (586 members, 34%), planters (186 members, 10%), retailers (83 members, 5 %), Environmental and nature conservation NGOs (38 members, 2%) banks (14 members, 1%), social and development NGOs (12 members, 1%), out of 1721 actors in total (OPECST calculations from data from the RSPO website).

78. According to the site www.rspo.org.

79. The RSPO-next label represents the highest level of requirement: complete traceability, absence of deforestation, exclusion of palm grove exploitation, slash-and-burn farming, etc., with verification of these commitments by an independent third party actor.

80. https://www.greenpeace.org/international/story/18478/forest-destroying-products-and-producers-times-up/

81. In 2015, WWF published a Certification Assessment Tool (CAT) to help analyse the strengths and weaknesses of certification systems.

82. Government certifications exist in Indonesia (ISPO) and Malaysia (MSPO), which aim to enforce national regulations step by step for all producers. They have less stringent criteria than RSPO but are mandatory. ISPO, developed by the General Directorate of Plantations of the Indonesian Ministry of Agriculture and implemented at the inter-ministerial level, has been mandatory for major producers since 2014, and will be phased in for small and medium sized farms. The MSPO certification scheme has been conducted by a specific body, the Malaysian Palm Oil Committee, since 2015, and is not mandatory.
See, for example, report of Marie-Hélène AUBERT, Jean-Jacques BÉNÉZIT, François CHAMPANHET and Michel-Régis TALON, "CGEDD and CGAAER report on the sustainability of palm oil and other vegetable oils", December 2016. http://agriculture.gouv.fr/durabilite-de-lhuile-de-palme-et-des-autres-huiles-vegetales

83. Which must meet certification levels recognised by the European Union, including ISCC - International Sustainability & Carbon Certification. The first multi-stakeholder standard, established in response to the "RED" directive created in Germany, it certifies 300 palm oil producers. Its level of requirement is equivalent to "Mass Balance" of RSPO.

84. Other schemes are close to such labels: POIG (Palm Oil Innovation Group) is a label promoting innovation, made up of a network of firms and NGOs, and requiring its members to be certified at 50% RSPO. Ecocert has certified palm oil products since 2010. An independent French body, recognised by the State for certification, it does not include stakeholders and mainly concerns "organic"products.

Experts consulted

- Ms. Marie-Hélène Aubert, Inspector General of the Administration of Sustainable Development, CGEDD (General Council of the Environment and Sustainable Development); Mr. Jean-Jacques Benezit, General Engineer of Bridges, Waters and Forests, CGAAER (General Council for Food, Agriculture and Rural Areas);

- Mr. François Champanhet, General Engineer of Bridges, Waters and Forests and Mr. Michel-Régis Talon, General Administrator, CGEDD, authors of the report "Sustainability of palm oil and other vegetable oils" of the CGEDD and the CGAAER;

- Ms Martine BAGOT, professor of medicine, head of department of dermatology at the Saint-Louis Hospital;

-Ms Emmanuelle CHEYNS, researcher at CIRAD in the social sciences, specialist in the certification issue;

- Ms. Elizabeth CLARK, World Wide Fund for Nature (WWF) Global Manager for Palm Oil;

- Mr Alain KARSENTY, researcher at CIRAD in the social sciences, specializing in forestry, the environment and natural resources;

- Mr Jean-Michel LECERF, nutritionist and endocrinologist, head of the nutrition department at the Pasteur Institute of Lille;

- Mr Philippe LEGRAND, professor at Agro-Campus Ouest, director of the Laboratory of Biochemistry/Human Nutrition. Author of the book *Un coup de pied dans le plat* [*A Kick in The Dish*], Marabout, 2015;

- Ms Irène MARGARITIS, university professor seconded to ANSES - head of nutritional assessment and coordinator for ANSES 2011 and 2015 reports on ANC (recommended nutritional intake) and trans fatty acid intake in food in France ;

- Ms Catherine MOLLIÈRE, member of the Friends of the Earth Federal Council and Mr Sylvain ANGERAND, Friends of the Earth Campaign Coordinator;

- Mr Alain RIVAL, CIRAD's oil palm correspondent, Regional Director for insular South East Asia. Author, with Patrice LEVANG (IRD) of the book "Palme des controverses" [The « palm » of controversy], Quae Ed., 2013;

- Mr Thierry THOMAS, Deputy Director, Therapeutic Medical Devices and Cosmetics Directorate, National Agency for the Safety of Medicines and Health Products (ANSM);

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