EU ILUC Methodology
Technical Assessment
Case SOY Argentina

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This document critically examines the European Commission's report COM(2026) 36 final (European Commission, 2026b). Based on an analysis of the methodology applied, productivity factors, assumptions regarding agricultural expansion, and the cited empirical evidence, it assesses the consistency of the report's conclusions when applied to soybeans produced under agricultural systems characterized by high production intensification and low deforestation.

This document does not analyze the economic or trade impact that this communication may generate for Argentina.

INDEX

Assessment of the EU ILUC methodological framework

1. **Indirect Land Use Change (ILUC), given the current state of international methodological development, which remains highly uncertain, should not be considered an environmental impact category directly attributable to a crop, nor a regulatory variable susceptible to robust quantification.**

2. The Intergovernmental Panel on Climate Change (IPCC)[1], the internationally recognized leading scientific authority on emissions accounting within the United Nations framework, does not define or operationalize ILUC as an explicit variable in its inventories, limiting accounting to observed and directly attributable land-use changes (IPCC, 2006; 2014; 2023).

3. The IPCC acknowledges that indirect effects may exist but emphasizes that they are highly model-dependent and subject to uncertainties that exceed the order of magnitude of the effect itself. For this body, ILUC may be considered as a research hypothesis, but not as a quantified regulatory variable. Consequently, by converting highly uncertain and model-dependent results into binding regulatory thresholds, Regulation (EU) 2019/807 departs from the internationally recognized IPCC methodology and la therefore lacks a sufficiently robust scientific basis for regulatory application.

4. According to ISO standards (ISO 14040:2006; ISO 14044:2006; ISO 14067:2018), which constitute relevant international standards for the World Trade Organization (WTO)[2], indirect land-use change is not a mandatory component of a carbon footprint, due to its model-dependent and non-attributable nature.

5. Considering the foregoing and reaffirming the conclusions of the WTO Panels in DS593 and DS600, it can therefore be concluded, based on the foregoing analysis, that no internationally agreed and recognized standard exists and recognized standard exists that would allow ILUC to be operationalized as a quantified regulatory variable.

6. Therefore, ILUC is not measured directly, but rather estimated through models that simulate how markets and land use respond to an increase in demand, with an inherently high and structurally irreducible level of uncertainty due to their strong sensitivity to productivity assumptions, representations of soil carbon stocks, the difficulty of attributing real causal relationships, and differences in temporal scale, all of which result in estimates that are inherently highly precautionary.

7. Consequently, this analysis supports a substantive methodological challenge to ILUC as a category of environmental impact, and it therefore should not, at present, be considered a quantified regulatory variable.

8. **The definition of a cut-off date, as a baseline, has a direct impact on the outcome of ILUC modeling and is only methodologically appropriate when applied to an empirically attributable impact.**

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[1] https://www.ipcc.ch/

[2] It complies with the criteria set out in Annex 1 of the Agreement on Technical Barriers to Trade (TBT) of the WTO.

9. In order to limit regulatory retroactivity, the EU adopts an ex-ante cut-off date of 2008 to assess land-use change associated with biomass destined for biofuels [3](Directives 2009/28/EC, 2018/2001/EU and delegated acts). However, using 2008 as a cut-off date to justify a "High ILUC risk" classification constitutes a regulatory extrapolation ex post that lacks methodological support in recognized international standards.

10. By contrast, under the Regulation on deforestation-free products (EUDR), the EU adopts 2020 as the cut-off date, translating Sustainable Development Goal 15.2 into a binary and verifiable criterion. This approach operationalizes the SDGs prospectively—particularly Goals 12, 13, and 15—by focusing the regulatory obligation on preventing new deforestation and ensuring effective supply-chain traceability, thereby avoiding the retroactive attribution of responsibility for historical land-use changes.

11. The divergence between the 2008 cut-off date under the RED and the 2020 cut-off date under the EUDR confirms that the EU itself implicitly recognizes that different regulatory objectives require different temporal reference points. While the EUDR adopts a recent and verifiable date, grounded in observational evidence and physical traceability, the RED applies an earlier date to a modeled and counterfactual impact such as ILUC, generating a methodological asymmetry that is not supported by international standards and reveals a lack of temporal coherence in regulatory approaches that purport to be equivalent.

12. **Consequently, the use of cut-off dates is methodologically defensible only when the regulated impact is empirically attributable, a condition that is not met in the case of ILUC. The methodologically more robust cut-off date is that of the EUDR, as it reflects monitoring and compliance capacity through country-level traceability platforms.**

Assessment of the cumulative criteria for determining High ILUC risk for soybean

13. **In general terms, the determination of risk criteria (criterion 1: expansion above 1%, and criterion 2: impact above 10%) is not systematized within a consolidated and fully traceable methodological framework.** The set of assumptions, data sources, and calculation formulas is dispersed across Directive (EU) 2018/2001, Delegated Regulation (EU) 2019/807, and successive technical reports (Phase I, Phase II, and periodic reviews), without a comprehensive presentation that would allow the determination process to be independently reconstructed. **This regulatory and methodological fragmentation hinders the independent replicability of calculations and limits the ability of exporting countries to assess ex ante compliance with the established thresholds.** Consequently, **the resulting classification operates as a broadly applicable regulatory presumption whose technical basis is not fully auditable, thereby affecting predictability and legal certainty in international biomass trade.**

Analysis of Criterion 1: Calculation of the proportion of expansion onto high carbon stock lands (x_{hcs})

14. **The formula proposed by the EU for calculating the proportion of expansion onto high carbon stock lands (X_{hcs}) is as** follows:

$$x_{hcs} = \frac{x_f + 2{,}6\, x_p}{PF}$$

- x_f = proportion of expansion onto lands referred to in Article 29(4)(b) (high biodiversity value) and (c) (high carbon stock) of Directive (EU) 2018/2001;
- x_p = proportion of expansion onto lands referred to in Article 29(4)(a) of Directive (EU) 2018/2001, wetlands including peatlands.
- *Factor 2.6* = weighting coefficient defined by the Commission reflecting that conversion of peatlands generates carbon emissions several times higher than those from other types of high carbon stock lands (regulatory parameter);
- *PF* = productivity factor.

Assessment of the crop expansion proportion term (X_f)

15. The variable X_f quantifies the proportion of a crop's expansion that occurs on lands with high biodiversity value or high carbon stocks. It is assessed in aggregate at the global level for the feedstock, regardless of the individual performance of each producing country.

16. In its calculation, a dual measurement criterion is established: net expansion and gross expansion.

- Net Expansion: includes all countries (both those that increase and those that reduce their cultivated area). This value is used exclusively for the "Entry Filter": if the rate exceeds 1% annually and affects more than 100,000 hectares, the crop qualifies for ILUC risk analysis.

- Gross Expansion: is used to calculate deforestation risk (X_{hcs}). The EU excludes countries with stable or declining area, focusing its determination solely on those that are expanding their agricultural frontier.

The use of two different metrics for successive phases of the analysis introduces a methodological asymmetry not explicitly justified.

17. The phenomenon raising concern in Europe is driven primarily by expansion in the Brazilian Amazon (growth from 0.4 to 4.6 Mha) and the Cerrado. However, the global

net growth rate has shown a slowdown, declining from 2.0% (period 2008–2019) (Webinar – High ILUC-risk fuels review) to 1.3% (period 2014–2021) (European Commission, 2026b).

18. The data considered by the EU for soybeans indicate production growth driven by efficiency, revealing a decoupling between area and output; while the rate of expansion has slowed, total production increased by 32% since 2008, suggesting a process of production intensification and yield improvement (from 231 million tones in 2008 (Guidehouse, GRAS & IIASA, 2022) to more than 306 million in 2014 (European Commission, 2026b)).

19. **The calculation of the X_f term reveals an inconsistency arising from denominator bias.** The methodology is technically asymmetric, as it uses net expansion to classify a crop as a "global threat," but relies on gross expansion to calculate risk. This obscures the contribution of origins that have reduced their cultivated area, such as Argentina (which reduced its soybean area by more than 2 million hectares over the past decade (Buenos Aires Grain Exchange, 2022)), which should operate as a compensatory factor.

20. **The calculation of the X_f term effectively nationalizes external risk by removing efficient countries from the denominator**, meaning that the impact of actual deforestation (e.g., in the Amazon) is not diluted. **This imposes a form of "collective responsibility" for individual actions**, whereby deforestation-free biofuels end up paying an implicitly "environmental tax" for the forest conversion carried out by their competitors.

21. **The calculation of the X_f term penalizes sustainable intensification, as the formula does not distinguish between deforestation and the restoration of degraded lands.** If a country increases its area through land rehabilitation (a low-ILUC-risk practice), it automatically enters the gross expansion denominator, artificially inflating the global risk percentage.

22. **The formula used to calculate the X_f term attributes observed land conversion to the crop based on spatial and temporal correlation rather than demonstrated causality, without modeling the underlying multicausal nature of the deforestation process.**

    Deforestation is a multicausal process:

    a. Concurrent activities: a large share of land conversion is originally linked to livestock production (the opening of pastureland) or logging, and only years later do soybeans occupy those already transformed soils.

    b. Natural causes: satellite models do not efficiently distinguish between planned deforestation and accidental forest fires or natural ecosystem

dynamics—limitations inherent to satellite classification when identifying direct causality (Hansen et al., 2013).

23. **From a technical standpoint, if a country reduces its cultivated area, its contribution to land-use change is negative or may be neutral. The EU disregards this neutrality, thereby penalizing producers who do not exert pressure on new forest areas.**

24. **In light of the foregoing, it would be methodologically more consistent for X_f not to be a single global value, but rather to be calculated by region, country, or production unit**, in order to reflect implemented good practices, georeferenced traceability systems, and governance structures related to deforestation, and to avoid being "locked into" classifications that do not reflect their actual contributions.

25. **Under a regionalized calculation, Argentina's Xf would be substantially lower than the global average and potentially close to zero in the absence of net expansion onto high carbon stock lands.** While the European Commission estimates a global average share of soybean expansion on forests of 8% (European Commission, 2019), local indicators for Argentina show that only 0.05% of production is located on recently deforested lands (Fundación INAI, 2023), which is consistent with the net contraction in planted area observed since 2008 (Guidehouse, GRAS & IIASA, 2026; CIARA-CARBIO, 2022).

## Analysis of crop evolution and land occupation by soybean in Argentina

26. Within the framework of the risk formula proposed by the EU, **the analysis of recent developments in agriculture and biomass constitutes a central input for assessing the empirical validity of the assumptions regarding expansion and land-use change**.

27. **The recent evolution of Argentine agriculture, with a focus on soybean, is adopted as a case study**, distinguishing two fundamental dimensions for a robust ILUC analysis: (i) production dynamics—planted and harvested area, output, and yield— and (ii) the effective physical occupation of land, taking into account rotations and double cropping. This distinction is relevant because, in systems with double cropping, "planted area" may reflect intensification (more than one crop per year on the same plot) rather than net expansion of agricultural land, which can lead to misinterpretations when attempting to link production with land-use change.

28. The available information for soybean in Argentina indicates that annual production results from the combination of three main components: planted area, effectively harvested area, and, in particular, interannual yield variability. In terms of data quality and internal consistency, the reported yield (kg/ha) is consistent with the ratio

between total production and harvested area, which allows this information to be used directly and in a traceable manner to analyze productivity and to interpret changes in production as a function of area and crop performance.

29. **Planted area reached a maximum in 2015/16 (20.56 Mha) and a minimum in 2022/23 (15.98 Mha) since 2008 (MAGyP, 2006)**. Following the decline observed between 2015/16 and 2022/23, a recovery in area is recorded in 2023/24 (16.56 Mha), along with a more pronounced increase in 2024/25 (17.99 Mha). **This pattern suggests that, in the most recent period, the dominant signal is not sustained area expansion, but rather fluctuations characterized by a contraction phase followed by recompositing.**

30. **Production exhibits greater volatility than area**. The maximum value for the period is recorded in 2014/15 (61.40 Mt), while the minimum corresponds to 2022/23 (25.04 Mt), a campaign that represents a clear break in the series. A significant recovery is subsequently observed in 2023/24 (48.21 Mt) and 2024/25 (51.11 Mt). This production range, contrasted with relatively narrower variations in area, indicates that annual output is strongly conditioned by yield and by the degree of effective harvesting.

*Figure 1 Evolution of planted and harvested area by soybean campaign in Argentina (2008–2025)*
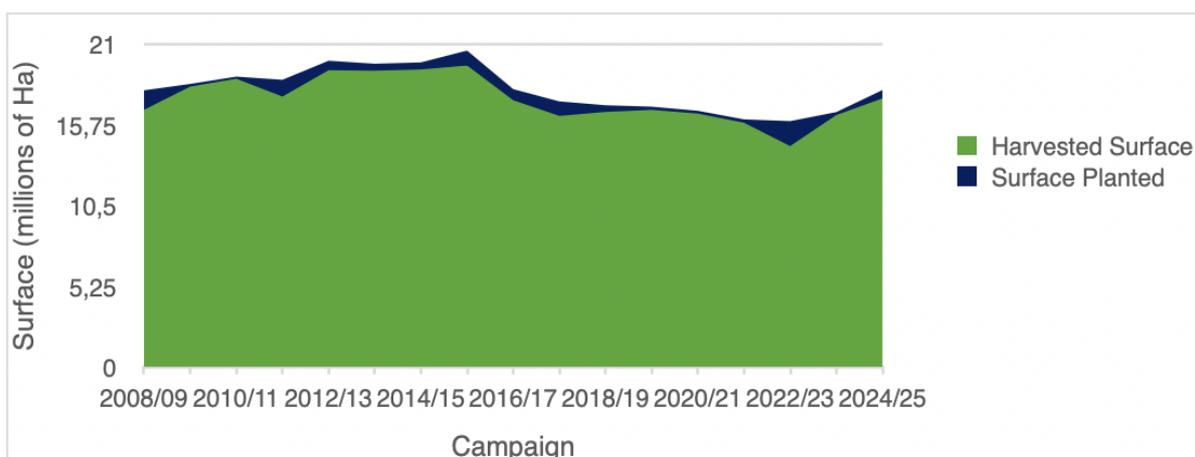
Source: MAGyP, 2026

31. **The difference between planted and harvested area is summarized through the harvest factor (Harvested/Planted), which averages 96.65% over the analyzed period (2008–2025)** (MAGyP, 2026). Maximum values are recorded around 2010/11 (≈99.27%), while the minimum is observed in 2022/23 (≈89.85%). This implies that, in an average campaign, the "unharvested" percentage is around 3.35%, whereas in 2022/23 it rises to approximately 10.15%, reinforcing the exceptional nature of that year (simultaneous impact on both yield and effectively harvested area). Therefore, to interpret declines in production (and, in particular, to avoid erroneous attributions to changes in area), it is methodologically appropriate to consider yield and the harvest factor jointly.

32. **Yield (kg/ha on harvested area) averages 2,712 kg/ha over the entire period, with a maximum in 2018/19 (3,334 kg/ha) and a minimum in 2022/23 (1,744 kg/ha).** This range is consistent with the crop's sensitivity to climatic variability and to campaign-specific agronomic conditions. Quantitatively, the correlation between yield and total production in the series is high (r ≈ 0.93), confirming **that production variability is explained primarily by changes in productivity rather than by changes in area.**

*Figure 2 Evolution of Argentine Soy Production (2008-2025)*
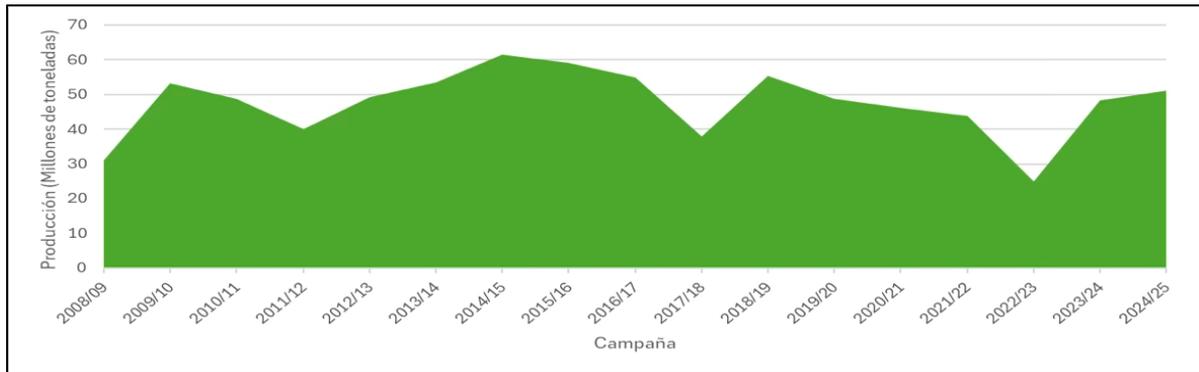
Source: MAGyP, 2026

33. To analyze indirect land-use change (ILUC) in Argentina, it is critical to methodological distinguish between:

- changes in the composition of agriculture (which crops gain or lose share);

- changes in the physical occupation of land (hectares effectively occupied without double counting). This distinction is especially relevant in double-cropping systems, where the same plot may host a winter crop and then second-crop soybean within the same campaign. In this context, increases in "planted hectares" may reflect temporal intensification (more cycles per unit of land) rather than net expansion of the agricultural frontier.

34. **The evolution of the planted area of first-crop soybean and second-crop soybean demonstrates the coexistence and variation of both components and confirms that part of soybean dynamics in Argentina is explained by adjustments within the production system and by the degree of adoption of double-cropping.**

Figure 3 Evolution of planted area with first-crop and second-crop soybean
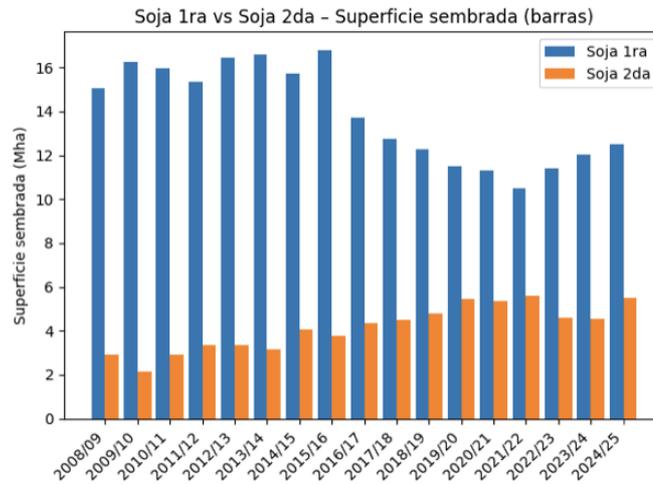
Source: MAGyP, 2026

35. In Argentina, a sustained increase (with interannual fluctuations) is observed in the relative share of second-crop soybean within the total (first-crop + second-crop soybean), which is consistent with **a process of intensification in agricultural land use and with the possibility of "adding" sowings within the same campaign without necessarily increasing the physical area occupied**. Since the 2008/09 campaign, first-crop soybean has consistently accounted for the majority of national production, although with a growing trend in the relative share of second-crop soybean. In absolute terms, first-crop soybean reached its maximum in 2014/15 (51.1 Mt), remaining above 44 Mt for most of the period 2010/11–2016/17. Second-crop soybean, in turn, shows structural expansion. In 2008/09 it represented approximately 13% of total soybean output (4.16 Mt) and reached a peak of 13.9 Mt in 2024/25, more than tripling its initial volume. Between 2018/19 and 2021/22 it stabilized within a range of 12–12.8 Mt, representing between 23% and 28% of total soybean production depending on the campaign. In relative terms, the share of second-crop soybean in total production rose from approximately 13–15% in 2008/09–2012/13 to values close to 25–28% in the most recent campaigns, reinforcing the interpretation of increased intensification through double cropping (MAGyP, 2026).

Figure 4 Percentage share of second-crop soybean relative to total soybean
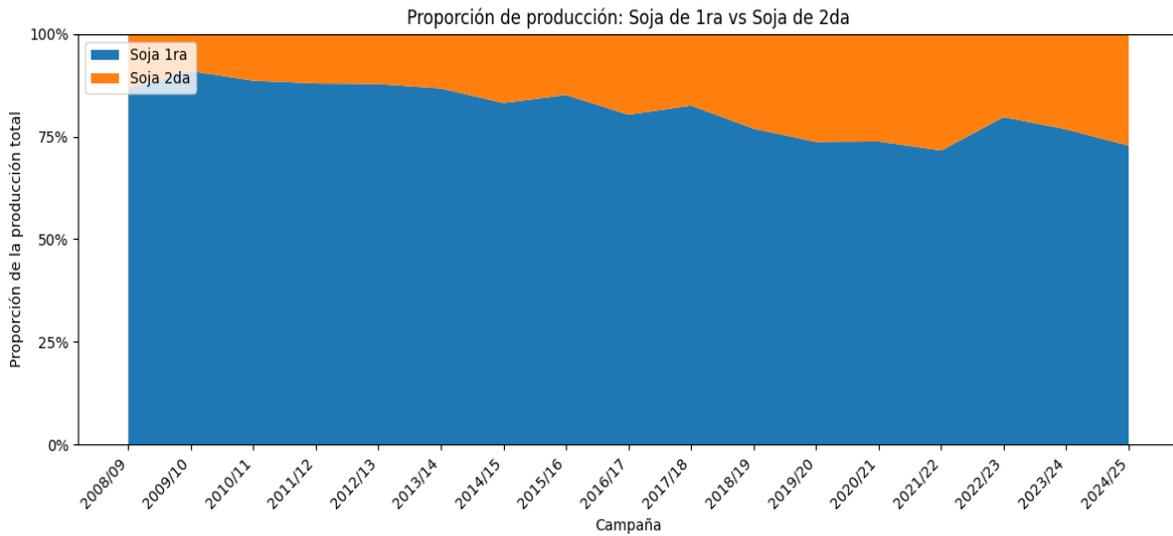
Source: MAGyP, 2026

36. **In double-cropping systems, the same plot may be planted twice within the same agricultural year; therefore, "total planted area" may count that plot twice, reflecting intensification (greater intensity of land use) rather than territorial expansion (AAPRESID, 2017).** This distinction is central to interpreting land-use changes without spurious attributions of land-use change responsibility—for example, confusing increases in "planted area" with expansion of area—especially when discussing links between agricultural dynamics, deforestation, and ILUC (Fundación Producir Conservando, 2022; MAGyP, 2026). Operationally, Figure 5 supports **the argument that ILUC analysis should be complemented with metrics of physical occupation (unique hectares) and spatial evidence of land-cover change in order to distinguish intensification from expansion.**

Figure 5 Share of planted area (grains)
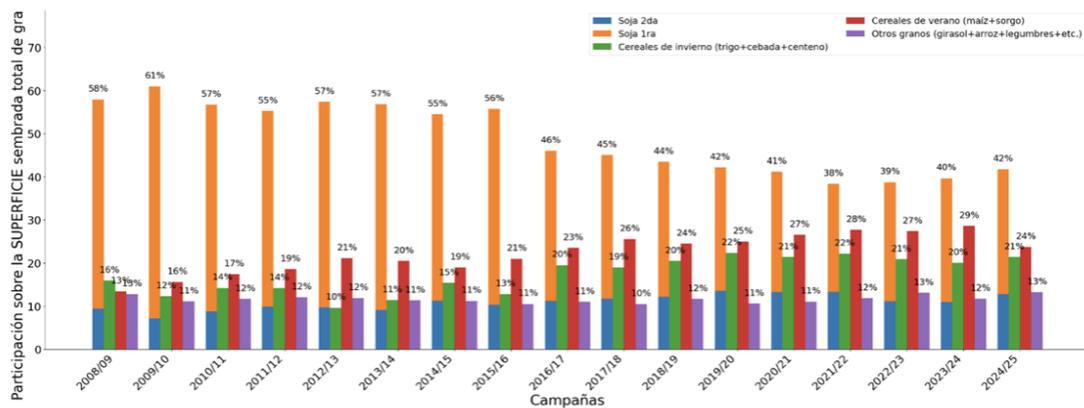
Source: MAGyP, 2026

37. In the same vein, **a synthesis based on sectoral sources reports that between 2017 and 2021 total planted area remained within a relatively narrow range (~35.5–37 Mha)** (BCBA, 2022; MAGyP, 2022; Fundación INAI, 2023), and that within this total soybean declined while maize and wheat increased; this pattern is consistent with a recompositing of rotations within a relatively stable total, rather than with net expansion of agricultural area, reinforcing **the need to avoid inferring territorial expansion solely from changes in the planted area of a particular crop** (Fundación Producir Conservando, 2022).

38. The relative share of first-crop and second-crop soybean (stacked) compared with winter cereals, summer cereals, and the aggregate of other grains allows agricultural dynamics to be interpreted as an internal recompositing of the production system (substitution and relative shifts among crop groups) rather than as direct evidence of expansion. In particular, the second-crop soybean component functions as an operational indicator of intensification associated with double cropping; its variation may increase "agricultural activity" as measured by sowing, without implying the incorporation of new land.

Figure 6 Share of production (grains)
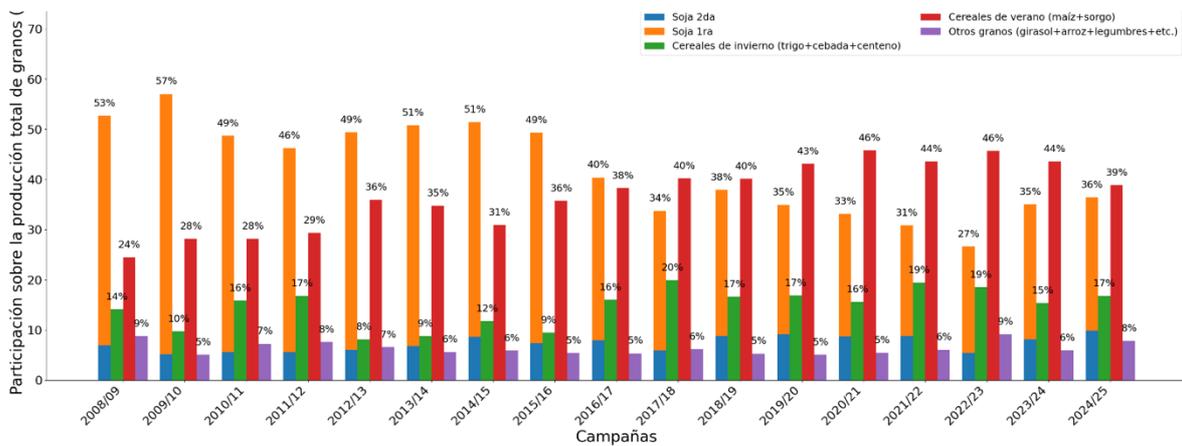
Source: MAGyP, 2026

39. Relative share, but in terms of tonnes produced (Figure 6), shows that relative participation may change due to yield variations (climatic conditions, technology, management), even when surface area does not change to the same extent. In other words, **an increase or decrease in a crop's production share may reflect a productivity shock rather than a proportional change in land use**. Therefore, for ILUC inferences it is methodologically more robust to use area as the primary signal of land use and to employ production as complementary evidence to distinguish between changes driven by area versus those driven by performance.

40. Taken together, **recent crop dynamics in Argentina can largely be explained by a recompositing of the grain matrix (relative shifts among major crop groups) and by intensification through double cropping (reflected in second-crop soybean), rather than by linear expansion automatically attributable to ecosystem conversion**. Direct attributions of the type "soy increases ⇒ deforestation increases" may be spurious if one does not control for the relative weight of soybean within the overall grain mix, the role of second-crop soybean as a form of intensification, and the possible divergence between signals derived from area and those derived from production.

41. **A proper ILUC assessment should integrate this evidence on production structure with spatial analyses of land-cover change (forest loss / land-use change) in order to distinguish net expansion from intensification and crop substitution**. This would prevent critical methodological biases, given that the current EU approach relies on gross expansion and asymmetrical time periods that often conflate crop substitution or double cropping with territorial expansion, thereby overestimating environmental impacts in regions that have increased production primarily through intensive margins and technological efficiency (European Commission, 2019; García et al., 2026 – ABIOVE).

Analysis of the estimation of emissions from deforestation and their allocation to crops

42. To determine annualized emissions from land-use change (e_l), the EU applies the following formula:

$$e_l = (CS_R - CS_A) \times 3,664 \times \frac{1}{20} \times \frac{1}{P} - e_B$$

- e_I, Annualized GHG emissions from changes in carbon stocks (g CO_2 eq/MJ).
- CS_R, Carbon stock per unit area associated with the reference land use (before the change).
- CS_A, Carbon stock per unit area associated with the current land use (after the change).
- 3.664, Conversion factor from carbon mass to CO_2 mass (based on the atomic mass ratio 44.010 / 12.011).
- 1/20, Amortization period (20 years). Total emissions are divided over 20 years.
- 1/P, Crop productivity (measured in MJ of biofuel per unit area per year).
- e_B, Bonus of 45 g CO_2eq/MJ if the biomass is obtained from restored degraded lands (under specific conditions).

43. The methodology assumes that, when a forest is converted into soybean cropland, soil organic carbon (SOC) degrades drastically due to tillage and soil exposure, releasing large quantities of CO_2 into the atmosphere.

44. To calculate carbon stock under the EU methodology, the following attributes are considered: aboveground biomass (carbon stored in trunks, branches, and leaves of living trees), belowground biomass (carbon in living root systems), soil organic carbon (SOC, typically measured within the first 30 cm of depth), dead organic matter (including litter and fallen deadwood on the soil surface), and correction factors for climate and soil type (such as peatlands, which have exceptionally high carbon density). All these values are compared before and after land conversion using land management and tillage intensity coefficients to determine the net loss of emissions.

45. The formula is based on the methodology for amortizing emissions from direct land-use change established in Annex V of RED II, drawing on the IPCC default factors (Tier 1).

46. **The aggregated application of the formula within the ILUC analysis framework assumes that observed expansion translates into conversion of lands with high carbon stocks,** without sufficiently distinguishing between types of expansion (for example, degraded soils that should be excluded).

47. **The methodology systematically assumes soil carbon loss from deforestation, without considering that deforestation primarily affects the carbon stock of aboveground and belowground biomass, which accounts for 93% of emissions from conversion in Argentina (Panichelli et al., 2009), and may not lead to significant soil carbon loss if appropriate management practices are applied (Murty et al., 2002; Peralta & Di Paolo, 2020).** These automatic assumptions have been technically challenged in the academic literature on ILUC (Searle & Malins, 2016).

48. **The formula assigns deforestation emissions to a single crop, without considering crop sequences in multi-cropping practices or the prorating of emissions across successive productions over a cycle longer than one year (20 years).** The temporal allocation of emissions under the 20-year amortization period may generate misalignments when the initial conversion was not induced by the crop currently present (Njakou Djomo & Ceulemans, 2012). In addition to this temporal bias, there is an overestimation of the original biomass: EU models often apply "Tropical Rainforest" or "Dry Forest" factors to the Chaco region, overlooking that many expansion areas are in fact secondary growth or shrublands degraded by centuries of prior livestock use, which artificially inflates the carbon density assigned to the initial stock (Panichelli et al., 2009; European Commission, 2026b).

49. **The methodology measures only emissions from conversion and does not account for subsequent carbon capture by the production system. The formula contains a bias in the Soil Model (SOC), as the EU uses IPCC default coefficients that assume conventional agriculture systems (tillage). 95% of soybean production in Argentina is carried out under no-till farming (NT). Studies by INTA (Hilbert et al., 2022) show that NT not only minimizes the loss of organic carbon but, in rotations with grasses and cover crops, can act as a net carbon sink. The EU overestimates CS_A loss by ignoring this technology. The use of default coefficients (Tier 1) may therefore fail to adequately capture the carbon dynamics observed under no-till systems widely adopted in Argentina.**

50. **The use of satellite datasets such as Hansen GFC detects tree cover loss exceeding 5 meters in height without necessarily distinguishing between permanent land-use change and temporary disturbances (fires, droughts),** which can generate discrepancies in the absence of ground validation. In the Gran Chaco, an extreme drought or a natural fire may temporarily remove tree cover without any conversion of land use to soybean. The EU "accounts for" these emissions as agricultural without ground-truthing, resulting in an inability to distinguish between satellite-detected cover loss and biologically driven change.

51. **The allocation of emissions within a given time window may attribute the entirety of historical conversion to the current crop, even when it was not the direct driver of the initial change.** The EU formula assigns the full loss of aboveground biomass to the subsequent crop. If land is cleared for livestock production (with a high initial emissions load) and soybean is introduced 10 years later, the EU often uses "time windows" that end up assigning that carbon footprint to soybean, disregarding that soybean was not the driver of the original change.

52. **The use of regional values (NUTS2 or equivalent) would make it possible to reflect agroecological and management differences.** The INTA 2022 report (Hilbert et al., 2022), adopted by the Commission, details that crop-related emissions in the Pampas and extra-Pampas regions are significantly lower than the default values of RED II, precisely due to efficiency in input use and the protection of soil carbon stocks.

53. **Additionally, if a production unit can demonstrate zero deforestation according to a cut-off date (EU RED or EUDR), it should be able to reflect a land-use change value equal to zero in emissions accounting.**

54. **Since soybean is a multiproduct crop, emissions allocation must be carried out in accordance with the energy or economic allocation criteria established in RED II.** In practice, the high protein content of soybean meal implies that a substantial portion of the crop's environmental burden is distributed to this co-product, reducing the intensity attributable to the oil used for biodiesel. The EU often focuses on the oil for biodiesel. In the case of soybean, the high protein density of the meal "absorbs" a

large share of the crop's carbon footprint, leaving the oil with a much lower emissions burden, which would meet RED II's 60–65% savings targets.

Analysis of tools/maps for deforestation estimation

55. The methodology used within the European framework to assess indirect land-use change (ILUC) risk does not directly observe "deforestation by crop." Instead, it infers feedstock expansion onto lands with high carbon stocks by combining:

    - layers of tree-cover change/loss,
    - auxiliary layers of loss drivers, and
    - layers of crop distribution/share for proportional spatial allocation.

    This approach is linked to the regulatory use of Delegated Regulation (EU) 2019/807 and to its technical implementation within the HILUC project framework (phase 2) to review the "feedstock expansion report" (European Commission, 2019; Guidehouse, GRAS & IIASA, 2026).

56. The set of geospatial layers is used to generate spatial estimates X_f (and, where applicable, X_p) and is not designed to establish direct causality at the plot level, but rather to produce aggregated estimates through proportional spatial allocation.

57. The Hansen Global Forest Change (GFC) dataset provides annual maps of tree cover loss at ~30 m resolution (Landsat), widely used as a global proxy for tree-cover loss. In this product, "trees" are defined as vegetation taller than 5 m, and "loss" corresponds to a stand-replacement disturbance (removal or severe change in cover), without identifying the cause or subsequent land use (Hansen et al., 2013). From an ILUC perspective, this input is robust for detecting where and when a change in tree cover occurs, but its interpretation requires caution, since tree cover loss does not necessarily equate to deforestation understood as the permanent conversion of forest to another land use, as it may include fires, logging, degradation, plantation rotations, or temporary changes. This distinction is explicitly noted in the reference documentation and in the HILUC Phase 2 review itself (Hansen et al., 2013; Guidehouse, GRAS & IIASA, 2026). If "loss" is interpreted as "deforestation" without additional filters (e.g., permanence of conversion, driver classification), it may lead to overestimation of permanent conversion when supplementary filters for permanence or verification of subsequent land use are not applied, and to the mechanical transfer of X_f to other analyses.

58. To approximate causality, the stack incorporates layers that classify forest loss into broad categories. A key reference is the global classification of forest-loss drivers that distinguishes, among others, "commodity-driven deforestation" (deforestation associated with permanent conversion for commodity production) from processes such as forestry, shifting agriculture, or fires (Curtis et al., 2018). In Phase 2 of the

HILUC project, an additional layer for the tropics was incorporated, based on a participatory validation campaign coordinated by the International Institute for Applied Systems Analysis (IIASA), which generated a set of "tropical drivers of forest loss" (IIASA-TDFL v1). The report itself documents that, in December 2020, 58 participants carried out more than 400,000 validations across approximately 120,000 locations, with a high-quality subset used to build the layer; and that the layer was designed to complement and harmonize definitions with Curtis (commodity-driven) by adding predominant drivers such as commercial agriculture, plantations (including palm), mining/oil, and pasture (Guidehouse, GRAS & IIASA, 2026; Laso Bayas et al., 2022). Even with these improvements, the driver layer operates with general classes and inherent residual uncertainty (especially when the real signal combines disturbances, degradation, forest grazing management, and partial conversions). This is critical because the "drivers → commodity-driven" step is the conceptual bridge between "cover loss" and "deforestation attributable to expansion of a commodity," which feeds X_f.

59. To assign the fraction of loss (and/or commodity-driven deforestation) to a specific crop, the approach integrates global agricultural distribution layers such as SPAM2010 (MapSPAM v2010) and layers associated with GEOGLAM. SPAM2010 represents crop distribution "circa 2010" on grids of approximately 5 arc-minutes (~10 km), using a downscaling/spatial modeling approach that allocates production and area based on statistics and covariates (Yu et al., 2020). These layers present two particular limitations:

    - Temporal mismatch (anachronism): since these are not annual layers, their use to allocate losses occurring in 2014–2021 implies assuming spatial stability in agricultural patterns, which may not hold in regions experiencing changes in rotations and crop composition. In practical terms, the risk is proportionally transferring loss to a crop based on its "historical" presence in a grid cell, even when the agricultural structure during the evaluated period has changed.

    - Scale mismatch: tree-cover loss at 30 m resolution is combined with crop allocation at ~10 km resolution. In heterogeneous production mosaics (typical of agro-livestock frontiers), this difference in scale can amplify allocation errors and generate spurious attributions (local loss assigned to a crop based on the average composition of a large grid cell).

This scale difference introduces a classic spatial analysis problem (the modifiable areal unit problem - MAUP) which can distort the proportional allocation of events when heterogeneous resolutions are combined.

60. To reduce allocation errors, the HILUC Phase 2 review incorporates regional mapping in hotspot areas. In Brazil, MapBiomas products are used, and for the Gran Chaco (Argentina, Bolivia, and Paraguay), soybean maps produced by Global Land Analysis & Discovery (GLAD) are employed (e.g., Song et al., 2021) (Guidehouse, GRAS & IIASA, 2026; Song et al., 2021).

61. For the Gran Chaco case, the report explicitly states that they did not have a nationally reported "dependable" source to validate the mapped soybean area for 2014–2021 (Guidehouse, GRAS & IIASA, 2026). **Even with regional mapping, if validation or cross-checking with national statistics or cartography is weak or absent, uncertainty in the crop layer propagates to the final attribution of expansion onto high carbon stock (HCS) lands (and, therefore, to X_f).**

62. **Since Hansen GFC detects tree-cover loss rather than legal or functional land-use conversion, there is a risk of confusing temporary disturbances with permanent deforestation.** This risk is particularly relevant in areas where fires and forest degradation are frequent, because part of the "loss" signal may not imply stable agricultural conversion (Hansen et al., 2013; Guidehouse, GRAS & IIASA, 2026).

63. **Attribution to commodities relies on driver classifications that contain residual uncertainty**. Consequently, errors or ambiguities in classification (e.g., fires vs. conversion, pasture vs. commercial agriculture, progressive degradation) directly affect the fraction of loss considered "relevant" for X_f. (Curtis et al., 2018; Guidehouse, GRAS & IIASA, 2026).

64. **The reassignment of events detected at 30 m resolution to crop proportions defined in ~10 km grid cells (or to regional maps without robust validation) can generate spurious allocations in heterogeneous landscapes.** This does not invalidate the approach as a global proxy, but it does require reporting uncertainty and avoiding "direct" causal interpretations for national contexts.

65. **In Argentina in particular, interpreting loss/deforestation requires integrating satellite evidence with legal instruments and official monitoring systems.** Specifically, Law 26.331 establishes minimum standards for the protection of native forests and a land-use zoning framework (OTBN), and the State maintains the National Native Forest Monitoring System (SNMBN) and UMSEF, which produce and publish information for annual monitoring of changes and updated cartography (Infoleg, 2007; SNMBN/UMSEF, n.d.). From an ILUC perspective, this integration is relevant for two reasons:

- Semantics and eligibility: "cover loss" (GFC) may include processes that, in local legal or ecological terms, are not equivalent to permanent conversion of native forest.

- Validation and uncertainty reduction: national layers (OTBN/SNMBN/UMSEF) can provide cross-checking and contextualization (by region, jurisdiction, and conservation category) to assess whether the signal detected by global products effectively translates into conversion relevant for X_f.

66. **Consequently, for Argentina, the interpretation of results based on a global stack must be triangulated with national or provincial information when the objective is to assess causality or regulatory compliance at a fine scale. In particular, "hotspot mapping" incorporates a regional soybean layer (GLAD) for Argentina/Bolivia/Paraguay, which improves spatial localization but does not replace the need to cross-check against legal frameworks and local monitoring systems when it is necessary to distinguish between cover loss, permanent conversion, and mixed dynamics.**

Assessment of the crop productivity term (PF)

67. **The Productivity Factor (PF) is a variable intended to compare the relative efficiency of a specific crop against a global reference value (weighted average energy). Its function is to determine how much energy (in terms of biofuels) is obtained per hectare.**

68. The European Commission uses a reference value based on the energy content of marketed products (oil) and co-products (meal/pellets) (European Commission, 2026a). A PF > 1 indicates that the crop is more efficient than the average, which helps reduce ILUC risk by requiring less land for the same amount of final energy (European Commission, 2026b).

69. In the new 2026 report (European Commission, 2026a), the EU assigns soybean a PF of 1.0, the lowest possible value, thereby considering that soybean does not have efficiency superior to the average of other biomass crops.

70. Although the methodological approach lacks full traceability, as noted previously, the formula presented in the Webinar – High ILUC-risk fuels review – Project results Phase 1 (July 2022 – Guidehouse) is adopted for this analysis, using data from Argentina to assess its methodological validity.
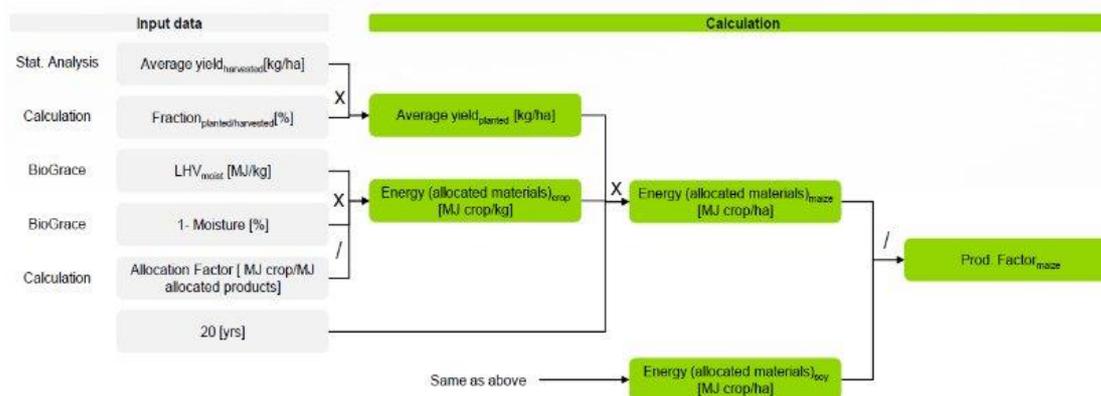
71. **The European report uses a reference value of 19 GJ/ha/year for soybean. However, technical data from the Argentine industry show that, considering oil and meal production under high-technology models, Argentine soybean generates 64 GJ/ha/year** (Hilbert et al., 2022; Panichelli et al., 2009).

72. **The EU uses as a comparison baseline crops that are not necessarily comparable in terms of energy balance or scale.** By assigning a PF of 1.0, it disregards the "sustainable intensification" achieved by the Argentine soybean cluster. In this way, the formula introduces bias into the crop reference framework.

73. **The European methodology entails an error in the energy matrix insofar as it tends to value primarily the oil for biodiesel, underestimating the energy value and importance of protein (soybean meal)**. By failing to adequately recognize the contribution of the co-product in the formula, the PF for soybean is artificially depressed.

74. **The PF in the formula proposed by the EU is calculated in a global and static manner, lacking local sensitivity.** The use of a global average value limits the model's responsiveness to significant regional differences in yield, technology, and agronomic management. It does not recognize that a producer in Argentina may achieve yields and energy efficiencies far above the world average due to the use of no-till farming and biotechnology.

75. **It is therefore proposed to recalculate the PF for soybean using the real energy values of each local production system, thereby promoting environmental efficiency. Under observed energy-yield assumptions in Argentina, the resulting PF for soybean would be substantially greater than 1 and could reach values close to 3 (3.4), depending on the allocation method applied.** This risk factor would drastically change the final risk equation. As the denominator of the risk formula, a higher PF automatically dilutes the impact of expansion (Xf), allowing soybean to fall below the 10% threshold and be classified as Low ILUC Risk.

Main technical weaknesses of the proposed formula

76. **The proposed formula presents a methodological "pincer effect" for soybean,** generating a combined effect in which a high numerator (aggregated Xf) and a conservative denominator (PF = 1.0) amplify the final value of the risk indicator.

    - It inflates the numerator (Xf) by using gross expansion and "nationalizing" third-party deforestation, thereby artificially increasing the Xf value.

    - It depresses the denominator (PF) by assigning a value of 1.0, ignoring actual efficiency, which prevents the denominator from "dampening" the result.

77. **There is a lack of proportionality, as the formula treats soybean as a simple system when it is in fact a complex one.** It does not adequately account for the fact that soybean simultaneously produces protein (meal) and energy (oil). **By failing to reflect the total mass balance, the formula unfairly penalizes the crop.**

78. **There is a temporal discrepancy:** 2008 is used as the baseline for analyzing crop growth, but this is combined with deforestation maps and regulatory frameworks (such as RED II) that use cut-off dates in 2020 or 2022. The use of different reference periods for expansion, deforestation, and regulatory thresholds may introduce temporal misalignments in the aggregated analysis.

79. Consequently, **Argentina maintains that the formula may generate significant trade-restrictive effects when it does not allow adjustments based on demonstrable regional performance. The claim is based on the premise that a global formula cannot serve as the basis for a trade sanction if it does not permit adjustments for proven regional efficiency.**

80. **In light of the foregoing, Argentina considers that the formula should allow the incorporation of validated national data.** If the actual Argentine energy yield were applied (PF = 3.4) together with local net expansion ($X_f \approx 0$), the country risk would be substantially lower, well below the 10% threshold.

Analysis of Criterion 2: Proportion of expansion onto lands with high carbon content < 10%

81. **According to GHG emissions calculations, the climate benefits of biofuels would be nullified if expansion onto lands with high carbon content reaches a threshold of 10%.**

82. Section 6.4.3 – Reflections on the threshold for expansion of the report (European Commission, 2026) analyzes the validity of the 10% threshold established in the

Renewable Energy Directive (RED II) to identify high ILUC-risk biofuels. This threshold was estimated as a tipping point in the 2019 report (European Commission, 2019) at 14%, considering: a minimum GHG saving of 52 gCO_2/MJ (required by RED II); annual emissions from expansion onto high-carbon lands of 19.6 tCO_2/ha/year; and an average energy yield of 55 GJ/ha/year. To avoid operating at the risk limit, the regulation applies a precautionary discount factor of 30% to this tipping point, resulting in a rounded value of 10% (Calculation: (0.052 × 55 / 19.6) × 0.70 = 9.8%).

83. **The current 10% threshold would be extremely strict for Argentina's productive reality, which—based on its own data for soybean and the area of Chaco forest—would yield a limit of 30%.** In the most critical scenario, if soil carbon loss were included, the resulting adjusted criterion would be 16%.

84. **One hectare of soybean in Argentina, based on a yield of 3 t/ha, produces 64.02 GJ/ha** (Bioenergy Report – Bioenergy Coordination – Ministry of Economy, April 2025).

- Energy per kg of Grain: 21:34 MJ/kg
- Total energy per hectare (Y): 3,000 kg/ha x 21.34MJ/kg = 64,020 MJ/ha 64.02 GJ/ha

85. The carbon loss from deforestation, considering the affected area in the Chaco forest, amounts to 7.77 tCO_2/ha/year under the formulas of EU RED II and RED III.

$$e_l = (CS_R - CS_A) \times 3,664 \times \frac{1}{20} \times \frac{1}{P}$$

Breakdown by Carbon Pools (Primary/Conserved Forest): for a well-conserved Dry Chaco forest, typical values are:

- Aboveground biomass (trees and shrubs): 64.30 t/ha × 0.47 (CF) = 30.2 tC/ha
- Belowground biomass (roots): 26.0 t/ha × 0.47 (CF) = 12.2 tC/ha
- Soil Organic Carbon (SOC): approximately 35–48 tC/ha when considering only the first 20–30 cm.
- Soil carbon loss is not taken into account due to no-till technologies and soil conservation and carbon-enhancement practices.
- Carbon loss from the conversion of primary Chaco forests: 42.4 tC/ha
- Result: (42.4 − 0) × 3.664 / 20 = 7.77 tCO_2/ha/year
  Source: Argentina Forest Reference Emission Level (2019)

86. Consequently, the calculation of the Inflection Point for soybeans from Argentina results in applying the same EU discount threshold in 30%.

$$T = \frac{S \times Y}{E}$$

- S = minimum savings required according to EU RED: 0.052 tCO$_2$e/GJ
- Y = energy yield: 64.02 GJ/ha/year
- E = emissions from land conversion (Argentine Chaco): 7.77 tCO$_2$/ha/year

$$T = \frac{S \times Y}{E} = \frac{0,052 \times 64,02}{7,77} = \frac{3,329}{7,77} = \mathbf{42,8\%}$$

- **Discounted threshold: 42.8% × 0.70 = 30.0%**

Proposed dynamic formula

87. **In order to remedy the regulatory inconsistency that currently exists between the EU RED and the EUDR, the EUDR "zero deforestation" condition should be considered a sufficient basis for reassessing the level of ILUC risk for biomass at the country level and should operate within the formula as a mitigation factor.**

88. Compliance with the EUDR should be recognized as verified evidence of the absence of direct land-use change (empirical evidence of reduced risk of conversion of high-carbon lands within certified supply chains). The proposed supporting evidence relies on comprehensive, verifiable geographic traceability and continuous monitoring—two conditions already embedded in the EUDR. This makes it possible to reinforce the observational character of ILUC within the approach used by the Commission, consistent with what is being proposed at the international technical level to advance its inclusion as a regulatory variable.

89. Without undermining the precautionary principle, maintaining ILUC as a systemic risk, but introducing the principle of proportionality—thereby incentivizing traceability and the demonstration of actual performance—it is proposed to incorporate an EUDR mitigation factor (MEUDR) into the formula.

90. Within the framework of the observational methodology used by the Commission, the mitigation factor associated with EUDR certification is proposed to be incorporated as a multiplicative adjustment to the parameter x_{HCS}, reflecting the verifiable reduction in the risk of expansion onto lands with high carbon stocks for certified volumes, without altering the productivity factors or the biophysical assumptions of the model.

$$x_{\text{HCS}}^{\text{EUDR}} = \left(\frac{x_f + 2{,}6\, x_p}{PF} \right) \times (1 - M_{\text{EUDR}})$$

91. It is proposed to define MEUDR as a conservative reduction factor for the attributable probability of expansion onto lands with high carbon stocks, applicable exclusively to volumes certified in accordance with Regulation (EU) 2023/1115.

$$M_{\text{EUDR}} = 1 - P_{\text{res}}$$

- P_{res}: residual probability of expansion attributable to HCS lands.

$$P_{\text{res}} = (1 - T) \times (1 - V) \times (1 - E)$$

- T: degree of geospatial traceability.
- V: level of verification of absence of conversion after 31/12/2020.
- E: effectiveness of enforcement and compliance mechanisms.

92. In accordance with IPCC/ISO practices, a precautionary factor of k $\in$ [0.4-0.7] is proposed to avoid overestimation.

93. For the purpose of adjusting the parameter related to expansion into lands with high carbon stock, the mitigation factor associated with EUDR certification may, on a conservative basis, fall within a range between 0.20 and 0.70, depending on the level of traceability, geospatial control, and explicit treatment of uncertainty. Under no circumstances shall this factor imply the complete elimination of the risk of indirect land-use change.

94. The introduction of a mitigation factor associated with EUDR certification can be formulated as an adjustment to the probability of conversion of high-carbon-stock lands, without modifying the land-use change activity data defined by the IPCC. This approach is consistent with the principles of ISO 14067, insofar as it relies on product-specific information and verifiable evidence to avoid the use of aggregated averages where more representative data are available.

95. **Integrating EUDR evidence into ILUC assessment would align climate policy with the objectives of a deforestation-free supply chain and strengthen incentives for traceable, high-performance production systems.**

Ex-post Low ILUC Certification

96. **Although the EU provides, in regulatory terms, an exceptional ex post pathway to certify Low ILUC through additionality, the ex-ante presumption of a crop as High ILUC effectively blocks such certification in practice. The risk thus becomes irrefutable.**

97. WTO Panels (DS593 and DS600) concluded that the European scheme creates a de facto irrebuttable negative presumption and does not provide a genuine, accessible, and operational pathway to demonstrate low ILUC risk. In doing so, it contradicts the very design of its own regulatory framework.

98. Leaving aside the previously described de facto exclusion based on risk, in the case of Argentine soybeans—a highly productive crop with average yields reaching 2.9 to 3.1 t/ha in the main producing regions (Hilbert et al., 2022; MAGyP, 2026)—compliance cannot realistically be demonstrated under the Low ILUC scheme proposed by the EU. Argentine soybean production intensifies output on established agricultural land, having reduced its planted area from a peak of 20.5 Mha in the 2015/16 season to approximately 16.5 Mha in 2023/24 (MAGyP, 2026; BCBA, 2022). Under European regulations (European Commission, 2026a), yield improvements must exceed a "dynamic baseline" in order to qualify as additionality measures, a requirement that is virtually unattainable for a system that already has no-till adoption above 92% (INTA, 2022). Since soybeans are not produced on abandoned or marginal land but rather within high-technology crop rotations, Low ILUC certification becomes a merely formal exception that is not practically applicable to Argentina's productive reality.

99. The European Union's ILUC regime is arbitrary within the meaning of the chapeau of Article XX of the GATT, as it establishes ex ante presumptions at the crop level based on aggregated models while simultaneously providing for a Low ILUC exception that is not reasonably accessible in practice. By requiring highly efficient producers to demonstrate the absence of systemic global indirect impacts—a technically impossible standard not supported by IPCC or ISO frameworks—the measure penalizes productive efficiency and undermines the substance of its own environmental rationale.

Conclusion of the evaluation conducted and Argentina's proposal

100. **The technical analysis conducted indicates that the methodology currently applied by the EU to determine ILUC risk—particularly the formula that combines the expansion term (X_f) and the Productivity Factor (PF) presents methodological**

inconsistencies that directly affect the regulatory classification of Argentine soybeans.

101.   **The methodological deficiencies outlined above affect the traceability, replicability, and proportionality of the regulatory mechanism. The application of a rigid global formula that does not allow for consideration of demonstrable regional efficiencies or the incorporation of validated national data may generate effects equivalent to a technical barrier to trade**, insofar as it conditions market access on the basis of parameters whose construction is neither fully verifiable nor adaptable to differentiated production realities.

102.   **It is maintained that the environmental objectives pursued are legitimate; however, their implementation must comply with standards of technical reasonableness, methodological coherence, and non-discrimination.**

103.   In this context, <u>**it is considered necessary to move forward with a technical review of the ILUC formula.**</u>

104.   **Willingness is expressed to participate in a structured technical dialogue process with the European Commission aimed at reviewing and strengthening the methodological basis of the scheme**, in order to ensure that regulatory decisions are grounded in transparent, verifiable criteria compatible with applicable international obligations.

105.   **The review of the formula would not only make it possible to correct potential methodological distortions and ensure a more proportional, transparent, and verifiable application of the scheme, but also strengthen its legal legitimacy and technical robustness within the framework of applicable international law, ensuring that the regulatory instrument effectively and coherently fulfills its ultimate objective of climate change mitigation without generating unnecessary adverse effects on global food and energy security.**

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ANNEX I: Representative calculations for Argentina (X_f, PF)
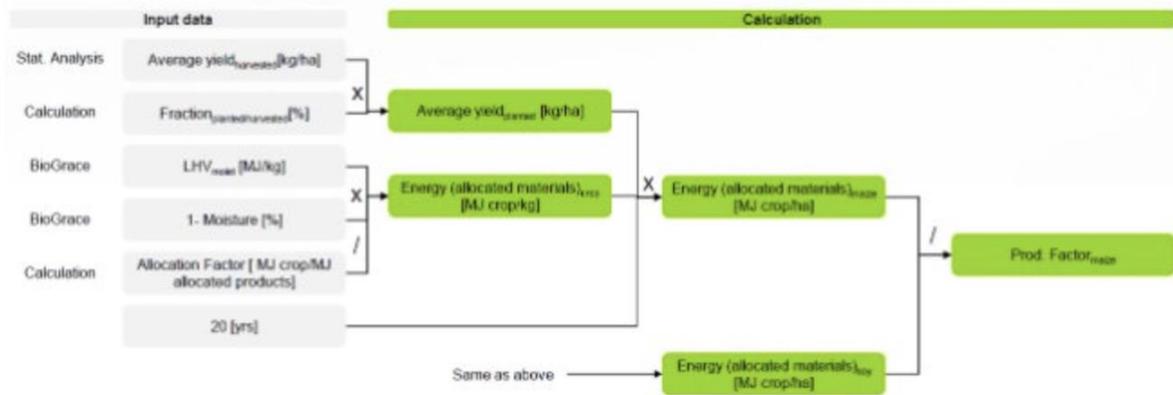
Yield per Hectare

- Average yield harvested: 3,000 kg/ha (national average value under normal conditions)
- Fraction planted/harvested: 1.0 (in Argentina, planted area coincides with harvested area)
- Average yield planted (kg/ha): 3,000 kg/ha × 1 = 3,000 kg/ha

Source: Bioenergy Report — Bioenergy Coordination Unit, Ministry of Economy, April 2025

Energy Calculation

- LHVmoist (Soybean grain): 18.32 MJ/kg
- 1 − Moisture: 0.87 (average moisture content of 13%)
- Allocation Factor: Total energy of coproducts (oil and meal)
- Oil energy (~19.4%): 0.194 × 37 MJ/kg = 7.17 MJ/kg
- Meal energy (~72.5%): 0.725 × 18 MJ/kg = 13.05 MJ/kg
- Hulls/other (~8.1%): 0.081 × 13.8 MJ/kg = 1.12 MJ/kg
- Total energy (energy crop): 21.34 MJ/kg of grain

Source: Bioenergy Report — Bioenergy Coordination Unit, Ministry of Economy, April 2025

Determination of Energy (allocated materials) per hectare

IMPORTANT: Annual energy provided by one hectare in Argentina (excluding double cropping with wheat or barley)

3,000 kg/ha × 21.34 MJ/kg = 64,020 MJ/ha/year (64 GJ/ha/year)

Real Productivity Factor (PF)

The European report assigns soybeans a reference energy value of 19 GJ/ha/year to establish a PF = 1.

$$PF_{\text{Argentine SOY}} = 64 \text{ GJ/ha/año (ARG)} / 19 \text{ GJ/ha/año (Base UE)} = \textbf{3,4}$$

Application of the proposed formula with adjusted PF term
PF calculated for Argentine soybeans 3.4
X_{hcs}= 14.1% + 2.6 x 0% /3.4 = **4.15 %**

Observation: Even accepting the global deforestation burden attributed to soybeans (14.1%), Argentina's high yield dilutes the risk below the 10% threshold.

If it is further considered that second-crop soybeans -primarily planted within wheat/soy double-cropping schemes during the same agricultural season- account on average for 25.5% of total soybean production over the last six crop years (MAGyP, 2026), it becomes evident that a substantial share of commercial volume originates from intensification processes (double cropping) rather than from expansion of the agricultural frontier. In land-use analysis terms, this means that total output (and potentially exportable volume) is generated partly on the same physical area within a single year, expanding the productive denominator without requiring additional hectares.

This point is methodologically relevant, as attributing increases in exported volume to surface expansion without distinguishing between physical land occupation and intensification leads to overestimation of land-use change.

Application of the proposed formula with adjusted PF and X_f terms
X_{hcs} (Argentina with double cropping)= 0.1% (verified by VISEC) + 2.6 x 0% /3.4 = <1 %

This exercise demonstrates that the "high risk" classification is an artifact of the aggregation of low-quality data and the underestimation of Argentina's technological efficiency.