Farm Europe

CONSEQUENCES OF FARM TO FORK AND BIODIVERSITY STRATEGIES

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FARM EUROPE

Resum

The F2F and BDS strategies, proposed by the EC, have been developed in the framework of the European Green Deal. They aim to reduce the negative environmental impacts of European agriculture and the food system, with the objective of reducing GHG emissions in this sector. These environmental objectives are accompanied by socio-economic challenges. Both strategies aim to promote "*sustainable and socially responsible production methods*", "*access to sufficient, nutritious and sustainable food*" and a transition to "*healthy and sustainable food consumption*". To this end, the EC has proposed various actions in its strategies, some with quantified objectives. The consequences of the application of 4 of these objectives, considered to be those whose impacts are the most apprehensible, have been studied. These objectives are :

The achievement of 10% of agricultural areas converted into **landscape elements of high environmental value.**

A **25%** increase in agricultural land devoted to **organic farming** by 2030.

A **-50%** reduction in the overall use and risk of chemical **pesticides**, and a 50% reduction in the use of the most hazardous pesticides by 2030.

A reduction in **nutrient losses** of at least **-50%** while ensuring that there is no deterioration of soil fertility, which will reduce fertilizer use by at least 20% in 2030.

The EC study, carried out by the JRC, its research department, shows **results that do not correspond to the expectations of the F2F and BDS strategies**. Indeed, the results indicate that the application of the quantified objectives of these two strategies would lead to :

A **drop in production** of more than **10%** in all agricultural sectors

A **deterioration of the trade balance** with an increase in imports and a decrease in exports.

A **decrease in farmers' income** in almost all agricultural sectors. In the sectors where an increase in income is recorded, it is subject to a disproportionate increase in prices for consumers (up to +43% for pork) and therefore unrealistic.

A **generalized price increase** for consumers.

A 20% reduction of agricultural GHG emissions in the EU, **half of which (66% non-CO2) is re-emitted outside the EU and the other half is offset by land use changes within the EU.** This reduction is more related to shifts in production types than to changes in the means of production.

If we integrate the impacts of **deforestation in third countries, the environmental balance for the planet** could be **negative: less EU agricultural production, more global GHG emissions.**

The application of the F2F and BDS strategies could therefore lead to the opposite of what they were created for. Several arguments are put forward to put these negative impacts into perspective. In particular, the JRC indicates that the negative effects of the F2F and BDS strategies observed in its study are exaggerated because its model does not allow for mitigating factors. However, **all the impact studies** carried out by different research organizations (Kiel, USDA, Coceral, HFFA, Wageningen), using different modeling methods, **show similar results**. In addition, some points in the JRC modelling minimise the negative impacts that F2F and BDS strategies could have.

<u>The socio-economic impacts of the study are underestimated:</u>

Modelling choices in the study minimise the costs to farmers (of implementing EC policy objectives), and prices to consumers. The exclusively monetary approach to modelling farm decisions facilitates the maximisation of farmers' profits. Decreases in the use of plant protection products (PPs), which are translated into reduced expenditure for farmers, are questionable, since these decreases in PP use would most likely be the result of a policy of overtaxing these products. The budgets used in the study are outdated and unrelated to the budgets finally adopted by the EC. Also, the adoption rates of mitigation technologies are totally theoretical (60% of farmers use precision agriculture in Europe in 2030 in the study).

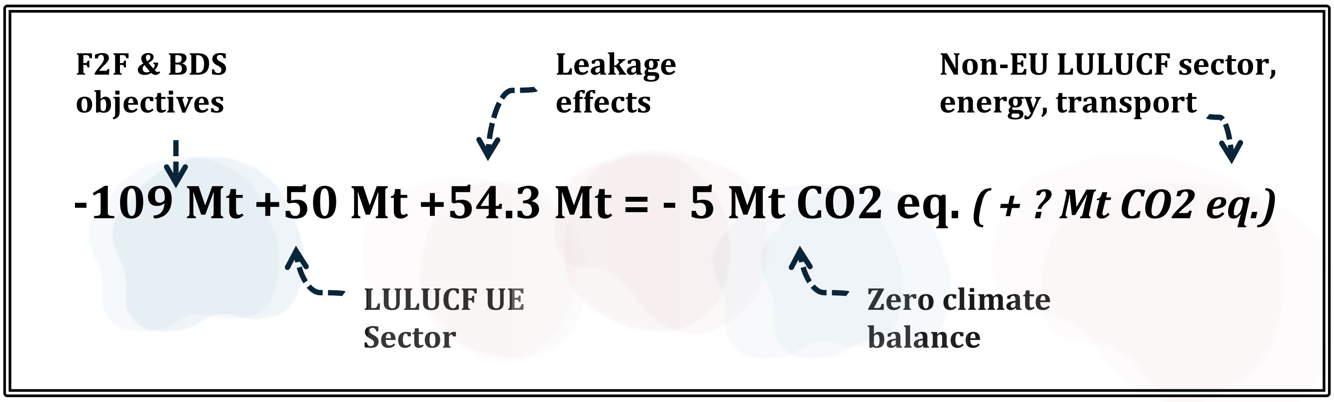
Only four objectives are taken into account in the study, the negative effects on production costs of measures such as the reduction of antimicrobial use, animal welfare regulations, planting of 3 million trees (etc....), are not taken into account. While, as the JRC mentions, there are potential synergistic effects within the F2F and BDS strategies, the antagonistic effects of the measures are not mentioned.

The EC relies on R&D and changes in dietary behavior to offset the negative impacts of F2F and BDS. However, the time frame for observing changes in dietary behaviour, or significant advances in R&D, is much longer than the time frame of the F2F and BDS strategies (2030). While such changes are undeniably necessary, the objectives of the F2F and BDS strategies, focusing on constraints and associated costs, would not allow to encourage them, creating a negative spiral where a positive policy of encouragement would be necessary.

The JRC study does not take into account the impacts of the strategies on the rest of the world. Other studies have done so, and show negative impacts outside the EU, if the F2F and BDS strategies are applied. They could lead to an increase in global food insecurity. The JRC indicates that the participation of the rest of the world would minimise the negative impacts. This hypothesis has been studied, and it could limit the effects within the EU, but the impacts for countries outside the EU - especially Africa - would be even greater.

<u>The positive effects on the climate are overestimated:</u>

The JRC does not detail the emissions related to the LULUCF sector in the EU (land use). However, other studies show that 45% of the GHG emission reductions in Europe would be cancelled out by this sector (KIEL). Moreover, the measurement of leakage effects does not include the energy sector, the transport sector, nor LULUCF outside the EU (thus the effects on deforestation). **Leakage effects are largely minimized in the JRC study.**
Moreover, the study **only takes into account** GHG emissions in these leakage calculations, **other types of pollution** are not considered. By integrating the LULUCF sector outside the EU and more important leakage effects, the balance is that **the European Union would be responsible for an increase of GHG emissions at the global level by the implementation of the F2F and BDS strategies as proposed.**



Climate balance (Kiel study)

PROPOSALS

There is no debate about the objective of a transition of the European economy and its agriculture to a GHG-neutral economy. It must take place without any loopholes.

The ways and means proposed to achieve this must be rooted in reality. Demagogic positions and sleeve effects must be avoided. The effectiveness of actions must dictate the path to be traced.

Most of the GHG reduction losses identified are related to leakage effects and LULUCF. To limit them, it is thus necessary to avoid EU production drops, to avoid that countries of the rest of the world have to compensate these drops at all costs, and emit more GHG.

For this, it is necessary to promote changes in the means of production, without impacting on the quantities and/or qualities of production in the European Union.

To really achieve these changes, the negative socio-economic impacts must be limited. The path to achieve this must be recalibrated.

Rather than starting with new constraints, we need to start by supporting, encouraging and promoting initiatives taken by the sector itself. For all sectors, there are now solutions that offer substantial environmental gains without compromising economic imperatives. These solutions can be put into practice without delay if the right incentives are given. The main ones are presented in the annex to this report.

In order to reap the benefits on a large scale, the European Union must plan a shock of investment and diffusion of innovation.

Precision farming is a powerful lever for maintaining or increasing yields while reducing emissions. However, it must be made accessible to a larger number of farmers.

It is also necessary to invest in genetic selection and to develop the potential of renewable energy sources offered by agriculture.

These are all sources of solutions - and income - that can accelerate the transition and European sovereignty. There is today an inconsistency to be corrected between the stated ambitions and the means put in front of them which are not up to the task.

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I. Background and objectives of the report

I.1 Background to the F2F and BDS proposals

In 2019, the European Commission is proposing a Green Deal in response to environmental degradation and climate change. The objective of this Green Deal is to make Europe "*the first climate-neutral continent by 2050*". This principle, endorsed by the European co-legislators, becomes the framework within which all the actions of the new commission must be carried out during its 2019-2024 mandate. In 2020, the Commission is putting forward an additional objective: to reduce GHG emissions by 55% by 2030 compared to 1990 levels.
In order to achieve these climate objectives, the Commission must propose a set of policy initiatives, grouped into strategies, which are specifically aimed at major policy areas.
Among the major themes identified, the EC indicates that it is particularly necessary to initiate a transition towards more sustainable food systems, which are currently identified as one of the main drivers of environmental and climate degradation. The 'Farm to Fork' (F2F) and 'Biodiversity' (BDS) strategies have been specifically developed and proposed by the Commission in 2020 to accelerate this transition.
At the same time as these strategy proposals, the Commission stresses the close link that may exist between certain objectives of the F2F and BDS strategies, which concern the agricultural sector, and the future CAP. The Commission's ambition is that the implementation of the CAP reform should be compatible with, and indeed serve, the objectives of the F2F and BDS strategies.

I.2 Why study these policy proposals?

The Commission has proposed the F2F and BDS strategies as part of the implementation of the Green Deal principles, but no justification for the objectives and measures proposed in these strategies has been produced. If, on the whole, the fact of proposing strategies concretising the Green Deal for the food chain sectors seems legitimate and coherent, some of the proposed quantified objectives and the suggested means of action raise questions. They have been proposed without a solid scientific basis, and no impact assessment was carried out before the Commission proposed the adoption of these strategies. No assessment of the possible consequences of these strategies was available at the end of 2020. It is only recently that the results of studies on the potential impact of the F2F and BDS strategies are becoming more widespread. In particular, the Commission has published a study proposing a simulation of the impacts of implementing some of the objectives of the F2F and BDS strategies. The Commission has tried to remain extremely discreet about these studies, downplaying the results of the one conducted by its own services, while these strategies will be implemented through legislative and non-legislative proposals (some 48) from the Commission that will run from 2021 to 2024. Specific impact studies are mentioned by the Commission for each of them. However, only a study analysing the impact of all the proposals to be made under the F2F and BDS strategies will make it possible to :

- to understand the value, the environmental, social and economic efficiency of the project that the Commission wants to carry out;

- and give the co-legislators, the European Council (i.e. the governments of the Member States) and the European Parliament, the elements they need to make informed choices that will have a profound impact on the European Union, its agri-food sectors, the daily lives of consumers and rural regions.

I.3 Objectives of the document

The purpose of this paper is to present the Commission's study on the possible impacts of F2F and BDS in an objective and didactic manner. The results of this study are compared with other studies carried out by other research bodies. These include a study by the USDA Research Service, a study published on behalf of the GrainClub by the University of Kiel, and relevant analyses by Coceral, HFFA and Wageningen University.
The comparison of the results between the different studies allows for the identification of potential convergent results. A reflection on the results will be carried out; it is essential to be able to correctly apprehend the points on which it is necessary to act in order to make these strategies operational, credible and ambitious tools. Proposals for alternative ways forward will be put forward in the light of the lessons learnt from the results of the analysis of this document.

II. Farm to Fork and Biodiversity Strategies

II.1 "Details" of the strategies, their objectives and functioning

The two political initiatives, F2F and BDS, target two major interrelated areas of action.
The F2F strategy specifically aims at *"a fair, healthy and environmentally friendly food system".* The measures and courses of action to meet such objectives are structured in the F2F strategy by levels of the food chain. They are divided among the stages of food production, processing/distribution and consumption, and include targets for food loss and waste. The objectives integrated in the production aspect concern in particular agricultural activity and practices. Ten policy actions are foreseen in this area, including 5 quantified targets (the only quantified targets in the F2F strategy).
The BDS strategy works in tandem with the "Farm to Fork" strategy. It aims, in the words of the Commission, "*to put Europe's biodiversity on a recovery path by 2030".* Overall, the measures proposed in this strategy to halt the loss of biodiversity concern the restoration of ecosystems and the strengthening of EU environmental legislation. Some components include targets that have a direct impact on the agricultural sector and its practices, and are in line with the quantified targets of the F2F strategy.
The quantified objectives common to the F2F and BDS strategies are the ones that have been mainly studied in the impact evaluations of these strategies.

II.2 JRC study of the European Commission's policy objectives

II.2.a What is the JRC?

The Joint Research Centre (JRC) is the European Union's scientific and technical research laboratory. This Directorate-General of the European Commission was created to provide scientific and technical support for the conception, development, implementation and monitoring of Community policies. As a service of the European Commission, the JRC acts as a reference centre for science and technology for the Union. The JRC has therefore been asked by the European Commission to carry out an evaluation of the impacts of the F2F and BDS strategies from 2019. However, the results of its work were not made public until 30 July 2021, almost a year after the researchers had completed their work.

II.2.b How did the JRC study these strategies?

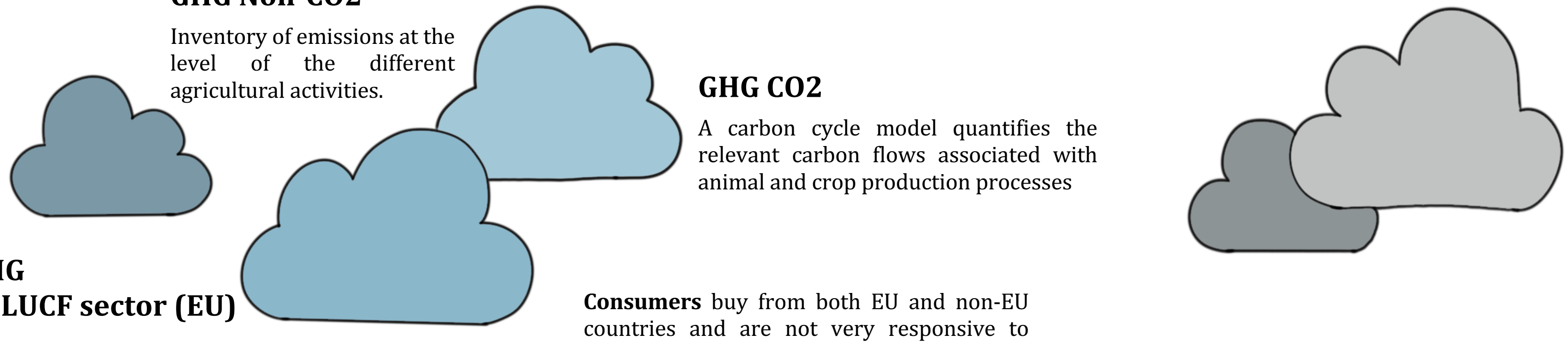
II.2.b.i Capri model

To carry out its study on the impacts of the F2F and BDS strategies, the JRC used an economic model originally developed for the ex-ante evaluation of agricultural and international trade policies, focusing on the EU. This evaluation tool, called the **CAPRI** (Common Agricultural Policy Regionalised Impact) **model**, has been used in particular to analyse the various CAP reforms in terms of their market and environmental impacts. Capri is financed by the EU and has been maintained and improved since the 1990s by a network of different European research institutions, including the JRC, which has made it possible to progressively include environmental and climatic aspects in the model, such as greenhouse gas (GHG) emissions, mitigation technologies, the carbon cycle, etc...

II.2.b.ii Modelling and assumptions

This section describes how the CAPRI model translates the world's political and trade decisions or directions into a simplified representation in a numerical model.
This model represents economic realities at different scales (farm, European market and international market), and integrates into this world model the different objectives of the F2F and BDS strategies, whose impacts have been evaluated in 3 different agricultural policy scenarios (all differing from what was decided under the CAP reform by the co-legislators).

Diagram of the CAPRI model operation



GHG Non-CO2

Inventory of emissions at the level of the different agricultural activities.

GHG CO2

A carbon cycle model quantifies the relevant carbon flows associated with animal and crop production processes

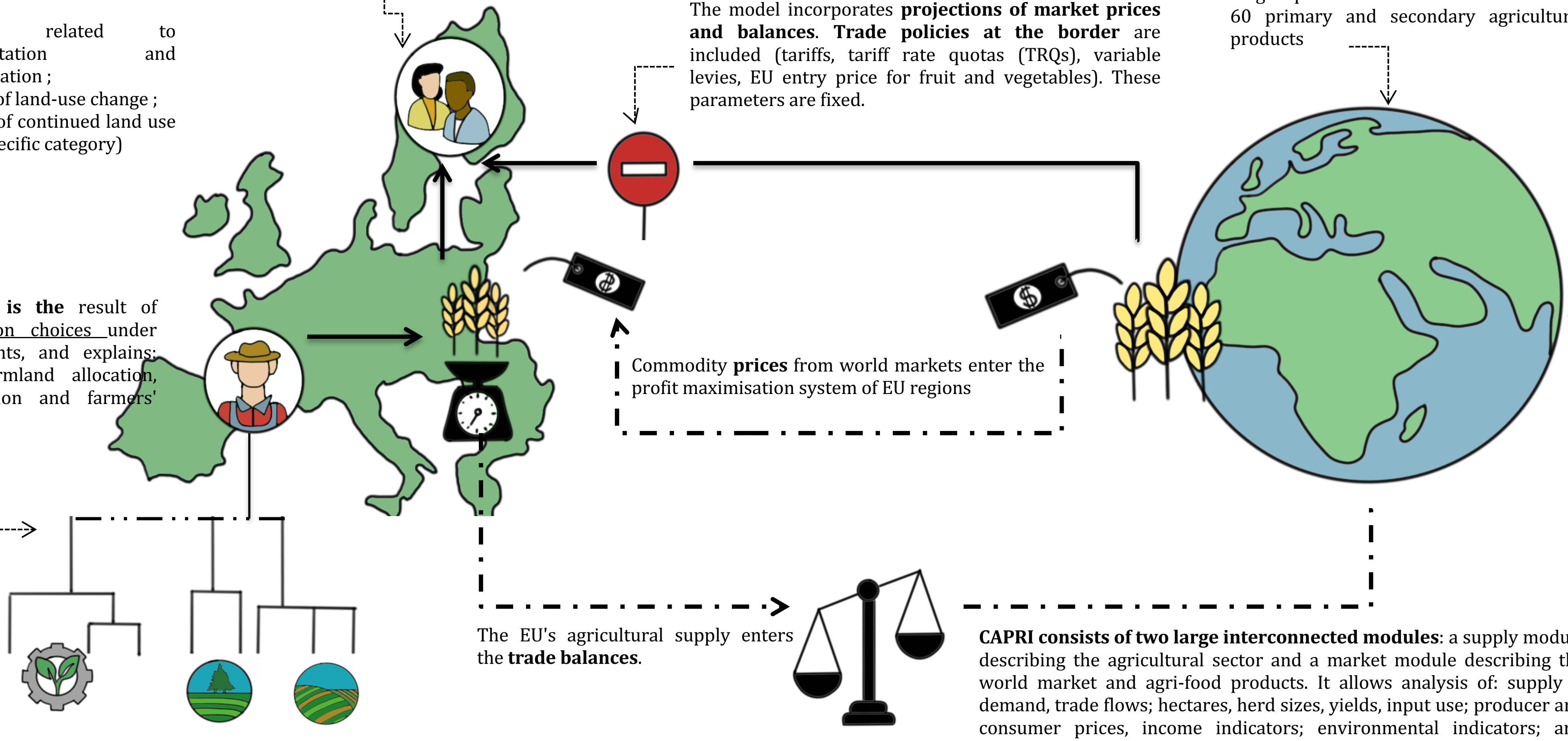
Leakage effects

Relocation of estimated emissions by accounting for emissions by product (per kg of agricultural product).
Emissions from energy, transport or LULUCF outside the EU are not included in these calculations.

GHG LULUCF sector (EU)

Inventory of emissions from land use change :

- effects related to deforestation and afforestation ;
- effects of land-use change ;
- effects of continued land use (in a specific category)



Consumers buy from both EU and non-EU countries and are not very responsive to price changes.

The model incorporates **projections of market prices and balances**. **Trade policies at the border** are included (tariffs, tariff rate quotas (TRQs), variable levies, EU entry price for fruit and vegetables). These parameters are fixed.

Multi-commodity spatial model
80 groups of countries in the world
60 primary and secondary agricultural products

Farm behaviour is the result of profit maximisation choices under technical constraints, and explains: resource use, farmland allocation, technology adoption and farmers' income.

Commodity **prices** from world markets enter the profit maximisation system of EU regions

The EU's agricultural supply enters the **trade balances**.

CAPRI consists of two large interconnected modules: a supply module describing the agricultural sector and a market module describing the world market and agri-food products. It allows analysis of: supply & demand, trade flows; hectares, herd sizes, yields, input use; producer and consumer prices, income indicators; environmental indicators; and welfare effects, including the EU budget for the Common Agricultural Policy (CAP).

The model incorporated a list of **mitigation technologies** (pre-existing in CAPRI) to improve agricultural emission inventories (CH_3, N_2O, CO_2). Their degree of adoption by farmers follows the profit maximization model and depends on mitigation costs, cost savings and other incentives (subsidies or taxes).

- Modeling the objectives of the F2F and BDS strategies

To measure the effects of the F2F and BDS strategies on EU agriculture, four of their quantitative targets proposed by the Commission were included. These targets were selected by the JRC as having the greatest potential to affect the environment and agricultural production. As mentioned in section II.1, some of the objectives are also the only quantified objectives common to both F2F and BDS.
These objectives are:

- a **-50%** reduction in the overall use and risk of chemical **pesticides** and a 50% reduction in the use of the most hazardous pesticides by 2030

- a **25%** increase in agricultural land devoted to **organic farming** by 2030.

- a reduction in **nutrient losses** of at least **-50%** while ensuring that there is no deterioration of soil fertility, which will reduce fertilizer use by at least 20% in 2030.

- **10%** of agricultural land converted into **landscape elements of high environmental value.**

These different policy objectives are implemented in the CAPRI model in the form of exogenous shocks that affect different parameters. This section presents the specific parameters that are used for each of the four objectives.

<u>Pesticide reduction target</u>

The reduction targets related to chemical and more hazardous pesticides are implemented in the form of reductions in the costs of using plant protection products (PP) for EU agricultural activities.
Since CAPRI models the use of CP through its costs to producers, the approach adopted is again entirely monetary.
The model therefore does not capture quantities but only expenditures, and does not distinguish between different types of plant protection products. To remedy this, an approximation of the target is modelled by the JRC as a 50% reduction in PP expenditure.

The reduction in CP expenditure is accompanied by some additional changes to reflect the alternatives that farmers can use to replace pest and weed control. The following changes in other costs are imposed at the same time as the 50% reduction in CP expenditure:

- **50% increase in other costs**, to reflect increased efforts in alternative practices such as mechanical weeding;
- **Increase the area of cover crops and catch crops by 25%** to reflect alternative practices such as mixing the main crop with others in the same field.

- Since the scenario assumes that reduced PPP use increases the risk of pest attacks on crops, in the absence of detailed data, the probability of pest attacks is assumed to result in **an annual yield loss of 10 %** on average. In this analysis, the worst-case scenario of 50% production losses was considered for cereals, oilseeds, vegetables, other arable crops and permanent crops.

Objective of reducing nitrogen losses

The policy target for nutrient losses has been translated into a target for reducing the gross nitrogen balance (GNB) for all EU regions.
CAPRI calculates the BAB for each region based on detailed nutrient flows between nutrient sources (chemical fertilizers, manure, crop residues) and their use (crop nutrient requirements, losses, etc.).
Specific targets for each region have been calculated. The nitrogen use efficiency is set at a threshold value of 75% efficiency. (This threshold value for nitrogen use efficiency is within the range of the maximum level recorded worldwide).) Progressive reduction targets have been applied. This led to an EU-wide reduction of 36%, with a maximum reduction of 87% per region and a minimum of 25%. When implementing this approach, the target for nine regions with high BAB values in the baseline scenario associated with a high number of animals, generated infeasibilities in the model, so the reduction target for these regions was set at the EU average (36%).

In order to reduce the nitrogen balance of the different agricultural sectors, CAPRI therefore incorporates into its model numerical restrictions that are binding for farmers, or at least for the different agricultural regions in the model. To mitigate their nitrogen balance, regions can in this model: change their agricultural areas and practices, and/or decrease the number of heads in the livestock production sector, and/or adopt nitrogen mitigation technologies (e.g. precision farming, nitrification inhibitors, etc.).
Again, the CAPRI monetary modeling system explains the choices of nitrogen mitigation pathways for different regions by choosing the scenario that maximizes their profit, or at least minimizes their costs.
It should be noted that this profit-maximizing model implies that farmers make more extreme decisions than they would in reality. Indeed, even if the non-linear CAPRI model tries to "smooth" farmers' decisions, they may, in order to meet a policy objective, decide, for example, to change agricultural sector, as this is the solution that maximizes their profit. In reality, however, many parameters have to be added.

Minimum organic area target

The policy objective of a minimum organic area has resulted in a combination of constraints and obligations.
The CAPRI model assumes that the target is achieved, so the take-up rate of the measure corresponds to the total agricultural area under organic farming defined in the F2F strategy.

Instead of implementing the specific target homogeneously in all Member States (MS) (i.e. all MS reach a 25% share), MS-specific targets were calculated taking into account the 2018 share of organic farming in the MS and the projected EU area under organic farming by 2030.
In CAPRI, to model the target that is imposed, the following assumptions about costs and returns are made:

- as mineral fertilisation is not allowed in organic farming, **the average use of mineral fertiliser in the region is reduced by the same percentage as the increase in the organic area target.**
- The relative reduction target is the same for each region of a MS, which de facto assumes that the MS target is achieved homogeneously in the different regions of the MS.
- **100% reduction** in plant **protection costs**;
- a **100% increase in fuel and service costs** to reflect the alternative farming practices implemented.
- a **12.5% increase in the minimum share of cover crops or intercrops**, which represent alternative weed control practices on the farm.

These parameters modelled in CAPRI therefore affect agricultural production in proportion to the specific organic farming conversion targets imposed for each Member State.

<u>Objective to increase landscape elements of high environmental value</u>

A policy objective regarding the increase of non-productive landscape elements and set-aside by 2030 has been simplified into a set-aside requirement.
CAPRI's regional agricultural models were confronted with a relative constraint of minimum set-aside area. This constraint, in principle, triggers a change in the land use patterns. The share of land use without intermediate or marketable products in the utilized agricultural area (UAA) is increased. The increase in the area of high diversity landscape features is therefore modelled as a requirement for an increase in non-productive land in each Member State.
The 10% set-aside target in the CAPRI model takes into account current levels of set-aside and area equivalents of linear landscape features. As 4.1% of the total UAA is already under set-aside and 0.6% of the UAA is covered by linear landscape elements in the EU, the target to be reached is only 5.3% of the total area. The deviation from the target is calculated at Member State level taking into account their 2018 levels and is implemented in a homogeneous way in all regions.
The choice of the scale of application of the set-aside target, 10% of agricultural land, is an important modeling parameter. A decision to apply this 10% per farm or sub-region would not lead to the same results and could have much more important consequences.

It should be noted that the fallow area has a zero gross N balance because there are no defined inputs or outputs for the fallow activity. According to the assumptions of the CAPRI model, the objectives of fallowing are therefore consistent with the objectives of mitigating the nitrogen balance. This point allows us to note that the different policy objectives of the EU are not independent. The CAPRI model has therefore tried to integrate this aspect in its modelling by making additional modifications and assumptions for the simultaneous integration of the 4 model objectives.

Modifications and assumptions for the simultaneous integration of the 4 model objectives :

In order to implement the four individual objectives simultaneously, CAPRI takes into account the interaction between certain assumptions made for each objective.

> Example with the Pesticide and Organic Scenario Synergy: First, the assumed expansion of organic acreage is measured, which results in pesticide reduction rates. The pesticide reduction target for conventional agriculture is then calculated by subtracting the pesticide reduction already achieved by organic farms from the initial target.

While the complexity of integrating the interactions between the different policy objectives in the CAPRI model does not allow it to cover all these synergies, they are clearly highlighted, and show the need to focus more on the overall objectives of the strategy rather than on individual objectives whose interdependence is not yet sufficiently taken into account.

- Modelling of CAP scenarios :

To assess the impacts of the F2F and BDS strategies in its study, the JRC presents several scenarios in which it incorporates the four policy objectives described above. These scenarios are:

- **1)** a representation of the CAP describing the implementation for the period 2014-2020 (CAP 2014-2020 scenario).
- **2)** an ambitious implementation of the post 2020 CAP reform proposals (CAP LP scenario).
- **3)** a post 2020 CAP implementation with the addition of an extra budget from the European recovery plan, made available as a grant to reduce the costs of specific technologies (CAP LP+NGEU scenario).

1 - CAP scenario 2014-2020 :

In the first scenario, the four quantitative objectives of the F2F and BDS strategies are integrated assuming that the CAP does not change from the implementation carried out in the 2014-2020 period.

2- CAP Post 2020 (CAP LP)

At the time of the JRC modelling work, the post 2020 CAP was still at the proposal/discussion stage, so its final details were not yet known. This scenario was developed by the CAPRI model, targeting the increased environmental benefits as defined in the initial objectives of the post 2020 CAP. A new CAP architecture was therefore modelled by CAPRI with a new budget allocation. As negotiations on the final

Multiannual Financial Framework (MFF) were still ongoing at the time of finalising the JRC report, assumptions were made and the budget retained reflects the figures in the 2018 proposals for the MFF. These figures no longer correspond to the budget that was finally adopted, which was lower than the budget originally proposed and used in the JRC study.

The new architecture of the CAP in this model is, in simplified terms, composed of 1) mandatory elements and 2) voluntary measures.

- The CAPRI model's **mandatory** post-2020 CAP **measures** have enhanced cross-compliance, with increased environmental constraints. Among the measures implemented under this reinforced cross-compliance, the CAPRI model has included a target of a 10% reduction in the use of pesticides.

- The CAP post 2020 **voluntary measures of** the CAPRI model are distinguished into ECS and MAEC measures to which 25% of the direct payments budget and 30% of the rural development budget are allocated respectively. These voluntary measures provide for a payment against the implementation of specific practices. Their adoption by farmers is therefore the result of the available budget.
  The CAPRI model integrates different practices into the ECS and MAEC measures, including three of the objectives of the F2F and BDS strategies, namely: reducing excess nitrogen, adding additional landscape elements and achieving 25% of UAA in organic farming.
  A remark can be made concerning the voluntary aspect of certain measures. Indeed, it should not be forgotten that the CAPRI model measures the impact of the application of the four quantified objectives of the F2F and BDS strategies, and that they can therefore be considered as "achieved". Farmers therefore do not "voluntarily" choose to adopt certain second pillar measures linked to the F2F and BDS strategies.

It should be noted that in the modelling of this new CAP, the choice of budget allocation between the different measures reduces the financial share allocated for investment and training. Indeed, the share of the budget for MAEC is increased (at the same time as the total real budget of the CAP is reduced), so farmers have less money for investment. This choice of budget allocation appears to be in contradiction with the objectives sought, since the reduction in investment aid would be a brake on the adoption of environmental measures.
Furthermore, it should be stressed that the supposed ECS measures are financed by the current income support. They will de facto reduce farmers' incomes, since the total amount of aid does not change, while they are associated with more environmental conditionalities, for which the additional costs and related burdens are not compensated.

3- PAC LP+NGEU :

This scenario is essentially the same as the CAP LP scenario, except that it incorporates an additional budget using assumptions about technology adoption costs.
15 billion in constant prices ('16.5 billion in current prices) was initially proposed in the New Generation EU (NGEU) and it is this budget that has been retained for the CAPRI

modelling of this scenario. It should be noted, however, that the budget used for modelling does not correspond at all to the budget finally proposed, which has been halved and is in fact 8.1 billion euros.

It is assumed in the model that the additional NGEU funds are used in full to subsidise investment in agriculture. This provision of a subsidy is an additional driver for the adoption of technologies and practices that lead to greater environmental and climate ambition. In the CAPRI model, this additional investment support leads to a cost reduction of 30% for technologies that require an initial investment for adoption. This reduction in the cost of technology adoption is also justified in the study by the increase in technology development, facilitated by the increase in Horizon Europe's budget allocation. The CAP LP + NGEU scenario differs only in the reduction of costs mentioned, and results in a theoretically higher level of adoption of these specific technologies.

III. JRC results and comparison to other studies

III.1 JRC results

The results of the JRC study can be grouped into broad categories of impacts:

- on **the food supply** ;
- on **the EU's trade balance**;
- on **farmers' incomes** and **consumers' prices**;
- on the **climate**.

These impacts, according to the results of the JRC study, do not match the expectations of the EC policy strategies. The results show a decrease in food supply, a deterioration of the EU's trade balance, an overall decrease in farmers' income, an increase in the cost of food for consumers, and relatively weak effects on the climate.

Regarding food supply in Europe, the results of the CAPRI study show a **reduction of more than 10% in food supply in all agricultural sectors** of the study. The scenarios considering the LP CAP, as mentioned in 2018, do not significantly change the results.
In the crop sector, the falls in production in Europe are mainly explained by the combined fall in yields and productive areas, due to the implementation of EU policy objectives.
In the animal production sector, the falls in production are mainly linked to reductions in livestock numbers, stimulated by the objectives of reducing the nitrogen balance.

With regard to the EU's trade balance, the CAPRI study indicates that the implementation of the EC's policy objectives would worsen the EU's trade position, with an increase in imports and a decrease in exports in almost all of the agricultural sectors in the study, whatever the scenario. While the cereals and meat sectors maintain a positive trade balance, a decrease in exports (up to -77% for pork) and an increase in imports (up to +39% for cereals) is observed.

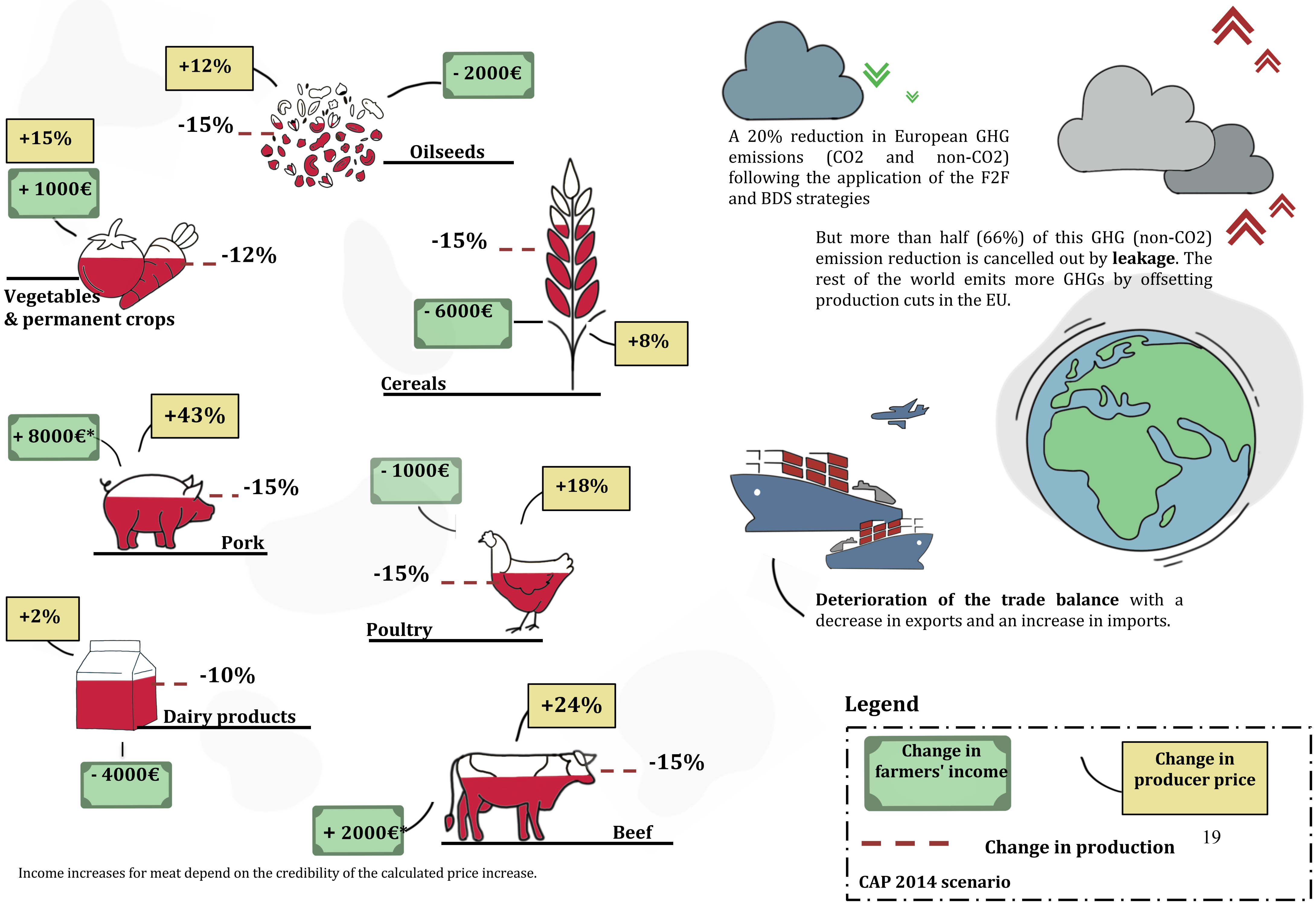
Farmers' incomes decrease in the CAPRI simulation for almost all agricultural sectors. In the CAP 2014-2020 scenario, this reduction in income is between -1000€ and -6000€ respectively in the poultry and cereals sectors. The increase in income for some agricultural sectors is linked to a disproportionate increase in prices for consumers. For example, in the pig sector, the increase in farmers' income of +8000€ is linked to a +43% increase in the price of pork for consumers. The CAPRI model applies a low elasticity of demand which explains why the increase in producer prices is almost entirely borne by consumers, and allows farmers in some cases to increase their income. In general, **an increase in prices for consumers in all agricultural sectors** is observed following the application of the objectives of the F2F and BDS strategies (ranging from +2% to +43% in the CAP 2014-2020 scenario). An increase in farmers' income, as modelled in the JRC study, is at the expense of consumers and only holds if prices increase to the calculated levels, which is questionable.

Finally, concerning the climate, the objectives of the F2F and BDS strategies make it possible to reduce GHG emissions from the European agricultural sector by 20% to 30%

depending on the scenario, but about half of these gains (non-CO2) is lost through leakage effects and the other half is also lost through land use changes in the European Union. Finally, the calculated reduction in GHG emissions (see discussion below) is relatively small, if leakage effects are included. This reduction is mainly linked to a drop in production in the EU. In the CAP 2014 scenario, only 38% of the total GHG emission reduction is linked to the new agricultural technologies and practices proposed in the CAPRI model.

The results also show that among the technologies selected in the JRC study, some have a greater impact on GHG emission reductions than others. In particular, winter cover crops account for the majority of the GHG reductions associated with the technologies in the CAP 2014 scenario. In contrast, other technologies result in increased emissions, notably manure application technologies (as modelled in CAPRI).

Results of the JRC study of the implementation of the F2F and BDS objectives in Europe *.



Income increases for meat depend on the credibility of the calculated price increase.

III.2 Other comparative studies

Other assessments of the impacts of EC policy objectives have been carried out. The results of five of these studies, USDA, Kiel, HFFA, Wageningen and Coceral are compared in this paper with the results of the JRC study. These studies do not approach the assessment of the impact of F2F and BDS in the same way as the JRC, and in this sense complement the finding of the possible effects of these strategies.

The USDA study approaches the evaluation of the F2F and BDS strategies by measuring the impacts of EC policy objectives. It considers the same policy objectives as the JRC study, except that it does not include the objective of increasing the area under organic farming, but does include the objective of reducing antimicrobial use by 50%. The impacts of these targets are simulated in three scenarios where the adoption of the F2F and BDS strategies is phased in around the world. In the first scenario, the EU "goes it alone", implementing its policy objectives alone. In the second scenario, the EU restricts imports from regions that do not adopt the Strategies, as an incentive for non-EU countries to adopt Europe's policy objectives. The last scenario assumes a global adoption of the Strategy, an extreme case which is supported by the EC in favour of this transition.
The model used to measure the possible effects of the EC policy objectives, within these three scenarios, is not the CAPRI model, but a model that integrates the market and the world economy (CGE model). Thus the USDA study, unlike the JRC study, measures the impacts of European strategies on the world as a whole, and is of interest in this sense.

The Kiel study incorporates the same objectives as those used in the JRC study, and uses the same model (CAPRI). However, it does not integrate these objectives into a simulation of the CAP (current or future), but distinguishes the scenarios by objective. In other words, each scenario corresponds to the application of an EC policy objective, which allows their individual impacts to be measured. In the last scenario the objectives are "combined", it is not simply an addition of the individual elements, but incorporates some interactions between the objectives of the F2F and BDS strategies.
The Kiel study provides a more detailed impact assessment than the JRC study. The impacts of the F2F and BDS strategies on the environment and climate are more comprehensive. Indeed, the study details the impacts of the strategies on biodiversity, but also on climate with a more complete approach than the JRC, since the emissions related to the LULUCF sector are detailed.

The Coceral study incorporates the same policy objectives as those used in the JRC study. It is not based on a complex model but on an empirical assessment of the transformation of cereal and oilseed production in the EU.
Four scenarios are considered, with increasing areas of arable land affected by the application of F2F and BDS measures.

The HFFA study incorporates the same policy objectives as the JRC study. It uses a multi-market model, where it does not directly measure the impact of the F2F and BDS strategies on EU agriculture, but rather the ability of varietal selection technologies to limit the production losses induced by the implementation of the two strategies.

The Wageningen study measures the impacts of the same objectives as the JRC study. It uses a partial equilibrium model (AGMEMOD) to provide projections of agricultural activities, and the evolution of supply and demand for agricultural commodities, for the different EU Member States. Four scenarios are examined to assess the overall impact on the main crop and livestock productions, each scenario examining the impact of one policy objective.

	JRC	USDA	Kiel	Coceral	HFFA	Wageningen
Modéle utilisé	CAPRI *(Modéle d'équilibre partiel)*	EGC *(Modéle d'équilibre général)*	CAPRI *(Modéle d'équilibre partiel)*	Evaluation emprique	MMM *(Modéle d'équilibre partiel)*	AGMEMOD *(Modéle d'équilibre partiel)*
Objectifs considérés						
Réduction de 50% de l'utilisation des pesticides	☑	☑	☑	☑	☑	☑
L'augmentation de +25 % des terres agricoles consacrées à l'agriculture biologique	☑	☐	☑	☑	☑	☑
Réduction des pertes de nutriments d'au moins -50 %	☑	☑	☑	☑	☑	☑
10% des surfaces agricoles converties en éléments de paysage à haute valeur environnementale.	☑	☑	☑	☑	☑	☑
Réduction de 50% de l'utilisation d'antimicrobiens	☐	☑	☐	☐	☐	☐
Scénarios	Simulations de la PAC actuelle, future + NGEU	Adoption des stratégies à différentes échelles (UE à mondiale)	Objectifs individuels et combinés	Superficie croissante de terres arables touchées par les mesures	Performances des technologies de selection variétales	Objectifs individuels et combinés
Mesure des impacts sur la production						
Céréales	☑	☑	☑	☑	☑	☑
Oléagineux	☑	☑	☑	☑	☑	☑
Légumes et cultures permanentes	☑	☑	☑	☐	☐	☑
Porc	☑	☑	☑	☐	☐	☑
Volaille	☑	☑	☑	☐	☐	☑
Boeuf	☑	☑	☑	☐	☐	☑
Produits laitiers	☑	☑	☑	☐	☐	☑
Mesure des impacts sur les revenus et les prix						
Revenus des agriculteurs	☑	☑	☑	☐	☑	☑
Prix des consommateurs	☑	☑	☑	☐	☑	☑
Mesure des impacts sur la balance commeriale de l'UE	☑	☑	☑	☑	☑	☑
Mesure des impacts sur le climat						
Emissions de GES dans l'UE	☑	☐	☑	☐	☑	☐
Considération du secteur UTCATF dans l'UE	**?**	☐	☑	☐	☐	☑
Effet de fuite	☑	☐	☑	☐	☐	☐
Considération du secteur UTCATF hors UE pour la mesure des effets de fuite	☐	☐	☐	☐	☑	☐
Considération du secteur de l'energie et du transport dans la mesure des effets de fuite	☐	☐	☐	☐	☐	☐
Mesure d'impacts socio-économiques hors UE	☐	☑	☐	☐	☐	☐

Table 1 - Comparison of JRC, USDA, Kiel, Coceral, HFFA and Wageningen studies on the impacts of F2F and BDS strategies.

III.3 Convergence of results

Despite different simulation methods and assumptions, the impact studies of the F2F and BDS strategies show converging results. This tends to demonstrate that the results recorded in these simulations are very close to the actual impacts that could be observed if the EC policy objectives were applied. Moreover, the fact that scenarios that simulate a different application of the EC policy objectives show similar results indicates that the impacts of these objectives are not only related to their means of implementation, but are more related to the objectives themselves. Only data from the JRC, USDA and Kiel studies are presented in the table below, as these studies cover the same data set. The data provided by the other studies, even if they do not cover such a wide evaluation, show similar results. Indeed, the HFFA and Coceral studies indicate a decrease in production in the cereals sector (-25% and -7% respectively), and in the oilseeds sector (-22% and -17% respectively). The Wageningen study also shows an overall decline in agricultural production. The volume of crop production in the EU has fallen by an average of 10% to 20%, and by as much as 30% for certain crops (apples). In this study, the trade balance deteriorates, with EU imports increasing and exports decreasing. Concerning agricultural incomes, the Wageningen study also observes similar results to the JRC, USDA and Kiel studies. For example, in the animal production sector, a dramatic increase in income is observed in the pig sector (in Denmark), with an increase of over 100%. Once again, the increase in farmers' incomes is linked in these studies to an increase in prices for consumers. In reality, however, these prices should not increase as much, as the costs would then be entirely borne by the farmers, whose income would therefore be much lower.

The results of these different studies show:

- An **overall drop in** European agricultural **production**, both in the animal and plant sectors.
- A **deterioration of the European trade balance,** with an increase in imports and a decrease in exports.
- A **general increase in the price of** agricultural products
- A **decrease in farmers' income** in most agricultural sectors. The increase in income observed in some sectors depends on a considerable increase in prices for consumers.
- **Limited or no climate impact**. GHG reductions are offset by additional emissions from LULUCF and leakage.
- **Negative impacts on the rest of the world**, similar to the impacts recorded in the EU (lower production, higher prices, lower trade, etc.), and an increase in food insecurity in the world.

EU impacts		JRC *CAP 2014 scenario*	USDA *EU scenario only*	Kiel *Scenario F2F*
Cereals	Production / Supply	. -15%	. ≈ -27%	. ≈ -21%
	Price	. +8%	. ≈ +65%	. ≈ +12%
	Revenues	. ≈ - 6000 €	. n/ a	. n/ a
Vegetables and permanent crops	Production / Supply	. -12%	. ≈ -5%	. ≈ -12%
	Price	. +15%	. ≈ +15%	. ≈ +15%
	Revenues	. ≈ + 1000 € *	. n/ a	. n/ a
Oilseeds	Production / Supply	. -15%	. ≈ -60%	. ≈ -20%
	Price	. ≈ +12%	. ≈ +93%	. ≈ +18%
	Revenues	. ≈ - 2000 €	. n/ a	. n/ a
Pork	Production / Supply	. ≈ -15%	. ≈ -7%	. ≈ -16%
	Price	. +43%	. ≈ +9.5%	. ≈ +48%
	Revenues	. ≈ + 8000 € *	. n/ a	. n/ a
Beef	Production / Supply	. ≈ -15%	. ≈ -13%	. ≈ -20%
	Price	. +24%	. ≈ +17%	. ≈ +59%
	Revenues	. ≈ + 2000 € *	. n/ a	. n/ a
Poultry	Production / Supply	. ≈ -15%	. n/ a	. ≈ -16%
	Price	. +18%	. n/ a	. ≈ +27%
	Revenues	. ≈ - 1000 €	. n/ a	. n/ a
Dairy products	Production / Supply	. ≈ -10%	. ≈ -10%	. ≈ -6%
	Price	. ≈ +2%	. ≈ +11%	. ≈ +29%
	Revenues	. ≈ - 4000 €	. n/ a	. n/ a
Trade balance	Imports	. ≈ Increase	. ≈ +2%	. ≈ +58%
	Exports	. ≈ Decrease	. ≈ -20%	. ≈ -43%
Farm income		. n/ a	. ≈ -16%	. n/ a
Agricultural product prices		. Increase	. ≈ +17%	. Increase
GHG emissions in the EU		. -20.1%	. n/ a	. -29% *(-109 Mt CO2 eq.)*
Emission-related reduction losses from the LULUCF sector		. n/ a	. n/ a	. +45% *(+50 Mt CO2 eq.)*
Reduction losses due to "leakage effects" (emissions outside the EU)		. 66%	. n/ a	. 49% *(+54.3 Mt CO2eq.)*
Global climate balance		. n/ a	. n/ a	. -1,2% *(-4.7 Mt CO2 eq)*
EU Societal Welfare (Billion $)		. n/ a	. -84	. -70
EU GDP (Billion $)		. n/ a	. -71	. n/ a

Table 1 - Comparative table of data from the JRC, USDA and Kiel studies on the impact of F2F and BDS in the EU.
The simulated increase in farmers' incomes is linked to the strong increase in prices for consumers.

Non-EU impacts	**JRC** CAP 2014 scenario	**USDA** EU scenario only	**Kiel** Scenario F2F
Farm income	. n/ a	. +2%	. n/ a
Agricultural product prices	. n/ a	. +9%	. Increase
World Trade	. n/ a	. -2%	. n/ a
GHG emissions	. Increase (by leakage effect)	. n/ a	. + 54.3 Mt CO2 eq.
Global food insecurity (Millions of people)	. n/ a	. +22	. n/ a
Global Welfare (Billion $)	. n/ a	. -96	. n/ a
World GDP (Billion $)	. n/ a	. -94	. n/ a

Table 2 - Comparative table of data from the JRC, USDA and Kiel studies on the impact of F2F and BDS strategies outside the EU.

The results show that the objectives of the agricultural component of the F2F and BDS strategies do not meet the EU's political expectations. Indeed, none of the challenges of the Green Deal are met:

- *"To strengthen the positive and reduce the negative impacts of agriculture on the environment*
  While positive ecosystem effects can be envisaged, the effects on climate are almost nil.

- "To *promote sustainable and socially responsible production methods*
  The negative economic and social impacts of F2F and BDS strategies make it impossible to envisage sustainable and socially responsible production if the EU's policy objectives are implemented as proposed.

- *"ensure access to sufficient, nutritious and sustainable food and promote healthy and sustainable food consumption"*
  The implementation of the F2F and BDS objectives would lead to an increase in global food insecurity, and the rise in agricultural prices in Europe would encourage consumers to consume more imported products, the health and sustainability of which cannot be guaranteed.

IV. Discussion of the results

In its study, the JRC repeatedly suggests that the negative impacts of the F2F and BDS strategies may be overestimated in its simulation. The JRC explains that its model and assumptions do not take into account certain factors that could mitigate the negative impacts of the strategies. However, the analysis of the JRC's CAPRI model shows that the negative impacts of the F2F and BDS strategies are also underestimated.
This section therefore proposes a reflection on the results and an analysis of the main arguments concerning their over- or under-evaluation.
The aim is not to put the various arguments on trial, but to get as close as possible to the real impacts that could be observed if the proposed objectives of the F2F and BDS strategies were implemented. The aim is also to highlight the points on which it is then possible to act so that the impacts of the F2F and BDS strategies come closer to the intentions they should fulfil.

IV.1 What about negative impacts on yields, production and prices?

At several points in its study, the JRC indicates that its modelling of the F2F and BDS targets in CAPRI leads to an overestimation of yield and production declines, and that the impacts on prices are exaggerated. In particular, the JRC explains that the additional positive environmental effects associated with the implementation of the targets are not appreciated in the modelling. These environmental gains could mitigate the negative effects on yields. These hypotheses, concerning possible positive feedbacks between ecosystem services and yields, are mentioned in the study through the reduction of pesticide use and the increase in organic farming. In this case, for example, spillover effects on the rest of the UAA are mentioned, through an increase in the number and diversity of insects, especially pollinators. The increase in high environmental value areas could also, according to the JRC, lead to an increase in yields, due to the potential for regulation of ecosystem services and natural pest control, which is enhanced by the presence of semi-natural vegetation and set-aside areas.
Thus, for the JRC, the potential positive environmental effects associated with the measures could lead to higher yields, and the effects on production could thus be reduced. The assumptions made by the JRC regarding the ecosystem benefits of the targets for yield and production remain assumptions. It cannot be denied that environmental gains can be beneficial, but to what extent, and how much, they are beneficial remains an open question. On the other hand, it has been established that the transition from a conventional system to a more sustainable system with constant technicality leads to a decrease in production.
While environmental gains can potentially be expected from the F2F and BDS targets, it is not clear that they will be able to mitigate declines in yield and production, especially if these declines are as dramatic as those recorded in the JRC study.

On several occasions, ecosystem services are mentioned in the study to minimize the negative impacts of the objectives on yields, production and therefore, in part, prices. It

should be noted that, on the other hand, several modelling assumptions minimise the economic impacts of the targets.
For the objective of reducing pesticides, CAPRI models the reduction of the use of plant protection products by farmers by halving their expenditure on these products. However, the decrease in the purchase of plant protection products in Europe will have as a corollary an increase in the price of these products. The reduction in farmers' spending on plant protection products in the CAPRI model is therefore very hypothetical. Moreover, as integrated in the parameters of the model, the reduction in the use of phytosanitary products is accompanied by an increase in other items, such as labour, fuel, etc... An increase in costs following the achievement of the objective of reducing pesticides must therefore be expected for farmers. The JRC study does not include this increase in its model.
Similarly, for the objective of increasing the area under organic farming, CAPRI considers that the adoption of this practice by farmers will reduce their plant protection costs by 100%. It is not specified in the JRC study whether these plant protection costs only concern chemical products or whether they concern plant protection products as a whole. Obviously the second option would be a more than inadequate assumption, since in organic farming many plant protection products are used, with higher prices for less efficiency per unit of product. The costs to farmers of achieving the EU's policy objectives appear to be underestimated.

The JRC also explains that its modelling of TRQs in CAPRI has an impact on the simulated increase in imports and would therefore indirectly explain the magnitude of increases in EU domestic prices. An analysis was therefore carried out to observe the effects of changing the setting of the tariff quotas, applying ad valorem equivalent tariffs (AVEs). Despite significantly lower import prices, this adjustment does not prevent EU domestic prices from increasing significantly (beef prices increase by 17% in the EU instead of 24% in the standard model). It should be noted that the application of additional import duties by the CAPRI model would go beyond the EU's border policy commitments and would open the door to counterclaims by the EU's global partners. Finally, a greater expected increase in imports would in fact have an impact on agricultural price levels, and thus farmers' income would pay the price.

Furthermore, the market modelling system itself tends to downplay the economic impact of the F2F and BDS objectives on agriculture.
Indeed, CAPRI's iterative process does not allow for an assessment of price developments for non-EU products. The market model also does not take into account political and economic developments such as those related to Brexit. Yet the UK is a key export market for the EU, and losses in this market will have a huge impact. Brexit will reduce EU exports to a UK market open to third countries. Exports of meat, dairy and other products will most likely fall, depressing both EU production, prices and farmers' incomes.
Moreover, the agri-food sector is not taken into account in the JRC study, nor in any other study. However, the organised decline of the agricultural sector would have a knock-on effect on the agri-food sector and would amplify the negative economic impacts, with job losses as a result, potential imports of additional processed products and a loss of competitiveness of the EU in exports. Thus, these assumptions and modelling methods in CAPRI minimise the economic impacts of the four objectives of the F2F and BDS strategies on agriculture in the EU.

For the JRC, the CAPRI model does not take into account the diversity of the territories in which it applies the objectives of the F2F and BDS strategies in a more or less homogeneous way, whereas an asymmetrical distribution of certain objectives over the territory could minimise the impacts on production. Thus the JRC explains that the objective of increasing high diversity landscape characteristics is modelled in a homogeneous way at the regional level, and therefore does not allow the impacts of this objective to be distributed in less productive regions, thus reducing the impacts on overall production. It should be noted, however, that the CAPRI model includes in its calculations the areas that are already considered as landscape elements in Europe. These areas currently amount to 4.1% of the UAA and already use the areas considered to be the least productive in the various regions of Europe. The objective of achieving 10% of the UAA as landscape elements of high environmental value will necessarily affect more productive regions, since it would aim to have an environmental impact on the whole of the territory and not to fulfil this function in each Member State by allocating areas in the least productive regions, which in fact present the least challenges in terms of environmental effort. Moreover, if the impacts could be concentrated on one or a few regions of a country, regions whose productivity/profitability is already lower could be more affected in terms of economic effects (threshold effect of basic economic activity), and the environmental benefits would not be greater. This would lead to a concentration of agriculture on the most productive areas, which would concentrate environmental problems with it. In particular, the Kiel study observed in its simulation an intensification of conventional agriculture, following the increase in organic farming, which partly offset its benefits (pesticide use is only reduced by about -7% with the objective of 25% of UAA in organic farming).
Moreover, the idea of concentrating these non-productive lands on the least favourable areas would not only have a negative impact on the agricultural economy, but also on the other economies of the territory. Indeed, the loss of an area's agricultural economy would have a cascading effect on its overall attractiveness.

Finally, the JRC indicates that the CAPRI model does not take into account the synergies of the strategies' objectives, which tends to exaggerate their negative effects. This argument is shared by IDDRI which indicates that other "*changes envisaged by the Commission*" could notably cancel out *"the effect of a reduction in inputs on volumes and prices".*
According to the JRC, the reduction in the economic impacts of the four F2F and BDS objectives is underestimated because not all the objectives covered by the strategies are taken into account. Indeed, only 4 objectives are studied in the CAPRI model, out of the 27 actions proposed by the Commission. The negative impacts of the strategies would be greater than if the interactions between the different actions were taken into account. For example, for the JRC, the production reductions linked to the switch to organic farming could be mitigated by the implementation of the action plan in favour of this form of farming.
While the JRC mentions potential synergistic effects, likely antagonistic effects are not mentioned. For example, some components of the F2F and BDS strategies could be added as production costs with the evolution of animal welfare regulations, or the reduction of antimicrobial use in livestock. While interactions between the objectives of the F2F and BDS strategies as a whole were not considered, interactions within the four objectives studied were not captured in the model either.

In fact, the four objectives studied were constructed independently of each other, even though obvious interactions exist. The setting up of these objectives at the individual level without taking into account possible interactions, underlines a rather weak scientific basis of the proposals made.
The USDA study finds that the separately constructed targets themselves are not controlled. Indeed, in the USDA study there are actions that exceed the targets: in many regions, cropland use has declined in their modelling by more than 10%, i.e. more than what was proposed by the EC in the strategies. This is generally because the decrease in agricultural production tends to be greater than 10% due to the more than 10% decrease in fertiliser and pesticide use.

Finally, although the JRC study explains on several occasions that the negative impacts on yields, production and prices are overestimated, the EC nevertheless assumes that since *"for decades economic growth has been at the expense of the environment"*, *"environmental benefits therefore imply short-term socio-economic disadvantages"*. IDDRI also indicates in one of its notes that *"for the EU, where current yields are close to maximum agronomic potential, the objective is indeed to reduce production marginally".*
The point is not to pit productivity and the environment against each other. On the contrary, the aim must be to combine them, to produce more with less input per unit produced, and to avoid a situation where the response (both in the EU and in the rest of the world, particularly Asia, South America and Africa) is to increase production by increasing the area of land to the detriment of the environment and the forest.

The four objectives of the F2F and BDS strategies were constructed individually despite obvious interactions. The lack of understanding of these objectives as a whole leads to certain gaps in the understanding of their impacts, but it is certain that we cannot ensure that the negative effects of these objectives, on yields, production and prices, are overestimated. Several points show that the JRC's CAPRI modelling actually minimises some of the negative impacts.

IV.2 Is the role of technology underestimated or overestimated in the implementation of F2F & BDS strategies?

In the CAPRI model, the role of technology in the implementation of the EC policy objectives is predominant. Indeed, in the CAP NGEU scenario modelling, the additional NGEU budget is entirely earmarked for investments that promote the adoption of mitigation technologies.
The NGEU budget retained by the JRC amounts to €16 billion, a budget twice as large as the budget actually set aside in the European recovery plan to achieve the agricultural component of the Green Deal (€7.5 billion).
Moreover, the €7.5 billion will be distributed to individual Member States, which will be free to use their financial envelope in their own way to support, in principle, the achievement of the objectives of the F2F and BDS strategies. Assuming, as the CAPRI model does, that Member States will dedicate their entire financial envelopes to support

the investment and adoption of mitigation technologies in agriculture is an ambitious assumption.

The additional budget used in the NGEU scenario of the CAPRI model to support investments and adoption of mitigation technologies is therefore out of reality. The assumption of a 30% reduction in costs for the adoption of these technologies is therefore also out of line. The role of technologies in the JRC study appears to be overestimated.

It should also be noted that the new CAP architectures, as modelled in the CAP LP scenarios, reduce the share of the budget for investment aid. In reality, farmers would therefore be faced with a reduction in investment aid, which would be a brake on the adoption of technologies.

The JRC indicates that in its simulation, the adoption rate of the technologies is underestimated since the initial adoption rate is assumed to be zero (which is not the case in reality). For the JRC, the potential of the technologies is therefore underestimated, since their adoption rate is depreciated. Yet the adoption rates observed in the CAPRI simulation seem very optimistic. For example, in the CAPRI modelling, the adoption rate of precision agriculture is 56% of eligible areas (in the NGEU scenario). This figure seems high in relation to the European adoption rate of these technologies, which is still much lower than that observed in other countries outside the EU (Brazil). In France, no more than 700,000 ha are currently using precision agriculture. If we consider, as indicated at the EU level in the CAPRI model, that 61% of the UAA is eligible for these technologies, this means that the rate of adoption of these technologies would have to be multiplied by 10 in less than 10 years....

It should also be noted that in the JRC CAPRI simulation, despite a higher rate of adoption of mitigation technologies in the CAP NGEU scenario, the results remain essentially the same. Indeed, there is still a significant drop in agricultural production, prices increase sharply, farm incomes decline just as much and the effects on the environment are no better. GHG emissions drop from -28.4% in the CAP LP scenario to -28.9% in the CAP NGEU scenario, before leakage effects and the impact of land use changes.

What explains the small decrease in GHGs despite an increase in technology adoption? The large share of emission reductions that is not achieved by mitigation technologies, but by lower production levels. This does not mean that technologies cannot contribute sufficiently to GHG reduction, but it could rather indicate that the technologies considered in the model are not necessarily adapted to the EU policy objectives. Indeed, the technologies included in the CAPRI model have been selected from the pool of technologies available in CAPRI for GHG emission reduction related to the general objective of the Green Deal, but have not been specifically developed and integrated with respect to the policy objectives set. This point highlights the need to reflect on the technologies to be put in place, considering first and foremost the achievement of the targets set. This thinking also needs to incorporate a wider range of parameters, as the impacts of a mitigation technology will depend not only on the agricultural activity and production system, but also on the type of region.

Finally, the JRC explains that the positive impact of technologies could be reinforced by the acceleration of technological development and efficiency improvements that are expected to take place by 2030. This view is shared by IDDRI, which indicates that innovation is poorly taken into account in the JRC study. Although the JRC and IDDRI seem to assume that research and innovation will be able to maintain adequate levels of

agricultural productivity, this may not be possible in the proposed time frame. Indeed, the time lags between investment in agricultural R&D and the resulting productivity gains are greater than two decades, and the implementation of restrictions would outpace innovation, resulting in regressive trends in production. It is clear that research and technology development will improve the effectiveness of mitigation technologies in the future, but the short time frame imposed does not allow F2F and BDS strategies to rely on them to minimize impacts on production, and improve GHG reduction performance. On the timeframe considered by these strategies, it is more appropriate to rely on existing technologies, and to consider each of them according to the desired results, the agricultural sector and the type of region. IDDRI also mentions that existing agronomic practices such as the "*reintroduction of legumes in rotation*" or *the "lengthening and diversification of rotations"* could *"partially compensate for the 20% reduction in nitrogen inputs".*
A real correlation between the technologies proposed and the results sought must be established.

In the JRC study, the budget allocated for mitigation technologies, and the simulated adoption rates are not credible. The role of technologies in the JRC study may therefore be overestimated. However, it is clear that the role of technologies could be much greater if their means of implementation were different. This is not to assume that it is future technologies that will mitigate the negative impacts of F2F and BDS, as research and development of new technologies is beyond their time frame. Rather, it is about thinking about existing mitigation options in a more flexible way, by farming system and by type of region, to propose technologies that are adapted to specific circumstances and maximise their potential.

IV.3 Can changes in dietary behavior minimize the negative impacts of F2F & BDS strategies?

According to the JRC, the reduction in animal production could have less impact on prices and trade if it is accompanied by a shift towards more plant-based diets. Indeed, a reduction in meat consumption would mitigate the impact on net trade since some reduction would already come from the change in diet, and there would be more production available for exports and less need for imports. This argument is shared by IDDRI, which believes that 'a *more plant-based diet, in line with World Health Organisation (WHO) recommendations (eating more fruit and vegetables and reducing consumption of animal products), could fully offset the effect on volumes caused by a reduction in the use of chemical inputs in Europe'.*
In the Kiel study, a decrease in meat consumption of -20% was simulated. The results effectively show a decrease in imports into the EU and a decrease in the price increase of agricultural products. This simulated reduction in meat consumption in the EU also reduces the GHG leakage effects in the model, from 54 to 31 Mt. It also leads to less production spillover in non-European countries induced by the F2F strategy.

The changes in net trade would also be smaller if the food waste reduction target were included, as some of the reduction in production would be mitigated by a reduction in demand. According to the JRC, a 50% reduction in food waste would lead to a reduction in food production of less than 1% for cereals and other crops, and almost 6% for meat.
More generally, the promotion of healthy diets and the appreciation of sustainably produced foods could lead to a reduction in consumer demand for environmentally challenging agricultural production, such as certain livestock systems, and its partial replacement by plant-based foods. Changes in dietary behaviour could indeed have a positive impact on prices, trade and climate. **However, it** should be noted that changes in dietary behaviour cannot be achieved in the short time frame of the F2F and BDS strategies. If these changes in dietary behavior are to occur, they cannot be counted on to minimize the impacts of the F2F and BDS strategies by 2030, since they are outside their time frame.
Finally, if adjustments on the consumer side are indeed effective measures to achieve the objectives of the Green Deal in agriculture, it should be noted that the objectives of the F2F and BDS strategies as currently defined would not encourage these changes. Indeed, it is difficult to imagine that higher prices and a reduction in the supply of fruit and vegetables produced in Europe would encourage consumers to adopt a more balanced and sustainable diet.

Changes in dietary behaviour, and particularly the reduction of meat consumption and food waste, can indeed facilitate a transition to more sustainable production systems and reduce GHG emissions. However, these changes in dietary behaviours go beyond the time frame of the F2F and BDS objectives, and it is not possible to consider these changes to offset some of the negative effects of the two strategies. Instead, it seems more appropriate to consider the negative effects of the F2F and BDS strategies that may impede these changes in dietary behaviour. In general, EU policy objectives need to better integrate the close links between them, and propose a set of coherent policy objectives and avoid counterproductive interactions a posteriori.

IV.4 What are the impacts of the EU strategy on consumers and society?

The JRC study notes that the report does not provide information on all the "benefits" arising from the objectives of the strategies studied, both for the agricultural sector and for society at large, as these "benefits" are not included in the model. In particular, the JRC mentions the ecosystem service benefits that the F2F and BDS strategies could provide for people. If such ecosystem service benefits exist, they are difficult to quantify and controversial. Other studies have measured and quantified potential impacts of F2F and BDS strategies on consumers and society in general, and the results do not indicate that they can be considered benefits.
Firstly, all the studies and simulations that measure the impact of the F2F and BDS objectives indicate that agricultural commodity prices increase overall in the EU. The

JRC study observes a price increase of up to +43% (for pork) and the USDA study indicates an overall agricultural commodity price increase of +17% in Europe, by 2030, if the F2F and BDS measures as proposed are implemented. The JRC believes that the increase in agricultural prices for consumers is due in particular to the low elasticity of demand parameterized in the CAPRI model. This low elasticity translates into a low responsiveness of consumers to price variations. An increase in producer prices is therefore borne entirely by consumers, when demand is modelled as inelastic, a modelling choice which therefore accentuates the increase in prices for consumers, who in reality are more reactive. However, it should be noted that if agricultural trade were to become more responsive, this would primarily redistribute costs, which would then be borne more by farmers and less by consumers. The hypothesis of increased trade responsiveness has been studied by the University of Kiel. The results show that the costs of implementing the F2F strategy are almost entirely borne by farmers through income losses, i.e. 40 billion euros (the equivalent of -242 euros per ha of UAA). It should also be noted that if the costs were borne more by farmers than the JRC study incorporates, then the impact on production would be greater, with a much greater reallocation of production outside the EU and, consequently, additional GHG emissions in non-EU countries.

Secondly, in several studies (USDA and Kiel) the evolution of societal welfare has been measured, and each of these studies indicates a regression in societal welfare following the application of the F2F and BDS objectives. The USDA and Kiel studies calculate a decline in societal welfare of -84 and -70 billion dollars respectively. It should be noted that social welfare is different from gross domestic product (GDP). Indeed, GDP is more a measure of production and investment, while societal well-being is more interested in the variation of consumer income. Changes in GDP are measured separately from societal well-being in the USDA study, which estimates that implementation of the F2F and BDS objectives would result in a -$71 billion decline in GDP in Europe.

Finally, studies of the impacts of the EC's policy objectives indicate that not only will there be few benefits for consumers and society, but also that the impacts will be asymmetrically distributed.
First of all, the economic impact is not the same for farmers in the different agricultural sectors, particularly between the animal and plant sectors. In the Kiel study, a decrease of -94 euros per ha of UAA is observed for cereals, it reaches -661 euros per ha of UAA for fruits and vegetables, while beef and dairy producers would observe an increase in their gross margin of 423 euros and 693 euros per animal, respectively (subject to the realistic aspect of the price increase put forward by the modeling).
The impacts are also unevenly distributed across the EU member states. In the Kiel study, the loss of welfare per capita ranges from -0.2% in Ireland to -1.5% in France.
It should also be stressed that within a given country, the different socio-economic classes will not be affected in the same way by the F2F and BDS strategies. Indeed, an overall price increase of 17% for agricultural products in the EU will affect more the less well-off and more vulnerable social classes.
Finally, climate and ecosystem effects will also affect Member States asymmetrically. In particular, the Kiel study indicates that biodiversity levels range from very low levels (0.41) in Slovenia to very high levels (0.8) in Portugal. GHG emissions from agriculture also show variations between MS, with emissions ranging from 0.9 t CO_2eq. per ha of land in Romania to 10 t CO_2eq. per ha of land in the Netherlands.

The asymmetry of the impacts of the objectives highlights the need to think about policy objectives where the costs and benefits of the objectives are achieved in a socially acceptable and equitable way between the different EU Member States, their regions, their agricultural sectors and their different socio-economic groups.

The benefits of the F2F and BDS strategies for society are not very visible. The implementation of the policy objectives would lead to higher prices, lower societal welfare and impact asymmetrically on member states, different agricultural sectors and social classes.

IV.5 What are the impacts of the F2F and BDS strategies on the rest of the world?

In the USDA study, the impacts of the F2F and BDS strategies on the rest of the world are measured. The results show that Europe will be responsible for an increase in food insecurity in the world, with 22 million additional people affected by 2030. This insecurity will affect more the regions where the populations are already the most exposed. In Africa and Asia an increase of +7 and +10 million food insecure people respectively could be observed. The EU as a developed region would be the least affected. This increase in the rate of food insecurity in the world can be explained in particular by a global increase in the price of agricultural products of +9%, which translates in part into an increase in the cost of food of +51$ per person/year. World trade is also affected by the EU's policy objectives. While some regions, for which the EU is an important trade market́, limit trade losses, the declines are greater than the gains for other regions, and world trade declines by 2%. Finally, implementing the EU's policy objectives would lead to a decline in global GDP of -$94 billion by 2030.
It should be noted that the studies do not consider the effects, most likely negative, of the F2F and BDS strategies on the environment of countries outside the EU. Indeed, the non-EU countries that would compensate for the drop in production in Europe would see their production increase by adopting agricultural methods and systems that are most certainly far from what Europe promotes. Non-EU countries would see a transformation of their ecosystem services towards more intensive agriculture, aimed at supplying the global agricultural market, which would be diminished by the increase in the EU's supply to this market.
The JRC study indicates that the impacts of F2F and BDS could be less significant for the EU and the world if the EU did not act alone and its F2F and BDS strategies were adopted by the rest of the world. However, a scenario where the world adopts the EU's policy objectives was modelled in the USDA study, and it shows that the global adoption of F2F and BDS would have even more negative impacts than the scenario where the EU acts alone. Indeed, a -11% drop in world production would be expected, agricultural prices soar (+89%), world trade decreases further (-4%) and world GDP reaches a -11 trillion dollar decrease.
In a world where global production must increase to meet the food challenge and where the availability of agricultural products must improve under a growing population, the global adoption of the F2F and BDS strategies would accentuate food insecurity, with

+185 million people affected by 2030. Once again, these negative impacts would affect more the already most vulnerable countries, and Europe would be the least impacted without its vulnerable social classes being spared.

If the objectives of the F2F and BDS strategies were implemented, Europe would be responsible on a global scale for an increase in food insecurity, a decrease in GDP and a decrease in societal well-being.
The global adoption of the F2F and BDS strategies, as suggested by the EC, would only aggravate the situation.

IV.6 Are the positive effects of F2F & BDS strategies on climate and environment real?

The results of the JRC study show that the objectives of the F2F and BDS strategies have a limited impact on the climate. The study indicates a reduction in emissions in the European Union of no more than -30% with half of this reduction (non-CO2) being lost due to an increase in GHG emissions in the rest of the world (excluding land use change). According to the JRC, the environmental impacts of the F2F and BDS objectives would be underestimated. Once again, it mentions the possible positive spillover effects not taken into account in the study. However, on the contrary, many points tend to show that the reduction of GHG emissions is on the contrary over-estimated in the JRC study.

First, the mitigation technologies in the study only consider a few GHGs: methane, nitrous oxide and sometimes CO2. The CAPRI model therefore only takes into account the effects of technologies on emissions related to these GHGs. The other effects of technologies on the environment or the climate are not necessarily taken into account. The measurement of the effects of mitigation technologies in the CAPRI model will therefore tend to overestimate their positive effects by measuring only a small part of their possible impacts, impacts that are those for which they were created, in order to minimize them, without taking into account the less favorable cross impacts.

Second, the JRC states at the beginning of its report that "*MS should ensure that net emissions from LULUCF are offset by an equivalent removal of CO2 from the atmosphere through measures in the sector, known as the 'no-debt' rule.* This is the only time the JRC report mentions the LULUCF sector. Indeed, in the presentation of the results of GHG emissions related to the EC policy objectives, emissions related to the LULUCF sector are not mentioned.
The Kiel study, which also uses the CAPRI model, measured GHG emissions from F2F and BDS. The results are similar to those of the JRC study, except that it adds to its results the emissions related to the LULUCF sector. Indeed, the GrainClub study details the changes in land allocation in the EU related to the implementation of the F2F and BDS targets, and indicates that 1.5 million ha of forest land could be replaced by agricultural land. These land use changes in the EU would result in additional GHG emissions. 50 Mt C02eq would be emitted from LULUCF in the EU by 2030, out of a measured 109 Mt C02eq reduction through the F2F and BDS strategies. Almost half of the GHG emission reduction would thus be lost. To these losses due to the LULUCF-EU

sector, leakage effects must be added. The JRC includes relocated GHG emissions in its calculations, and more than half (66% non-CO2 in the CAP 2014 scenario) of the emission reductions in the EU would be cancelled out by increased emissions in the rest of the world. For the sake of completeness of the GHG emissions balance we will however use the leakage effect calculations of the Kiel study, which integrates and details the LULUCF sector unlike the JRC study. The Kiel study measures an increase in GHG emissions in the rest of the world of 54.3 Mt CO2eq. or 49% of the reduction in GHG emissions in the EU that would be caused by the F2F and BDS strategies.

Finally, when integrating LULUCF and leakage effects into the GHG emissions balance, the reduction of 109 Mt CO2eq due to the EC policy targets is offset by an increase of 50 Mt and 54.3 Mt CO2eq respectively. This means that only less than 6% of the GHG emission reduction through the F2F and BDS strategies are effective (i.e. 1.2% net GHG emission reduction compared to the current situation).

This figure is actually even lower. Indeed, as mentioned in Part I, leakage effects do not include the LULUCF sector in the rest of the world, nor the energy and transport sector. The Kiel study measured forest area losses in the rest of the world, and these amount to -5 M ha of forest if the F2F and BDS strategies are applied in Europe. While emissions from land allocation change outside the EU are difficult to quantify in the model, the reduction in forest area indicates that the LULUCF sector, if included in the leakage calculations, would further increase emissions outside the EU. The inclusion of the energy and transport sector in the leakage calculations would also lead to an increase in emissions outside the EU without any debate.

Moreover, in the CAPRI model calculations of leakage effects, agricultural practices in non-EU countries are not taken into account. Any form of pollution other than GHG emissions is not taken into account. Thus, pollution linked to nitrogen drift, to the use of phytosanitary products (etc...), leading to pollution of soils, rivers, oceans (etc...), are not integrated.

All of these unconsidered elements indicate that while it is certain that the F2F and BDS strategies as proposed have no effect on the climate, it is very likely that they could have negative effects, with increased GHG emissions.

The environmental effects of the F2F and BDS objectives on the climate are zero or even negative.
Indeed, when integrating the GHG emission reductions due to the application of the F2F and BDS strategies with the leakage effects and the emissions related to the LULUCF sector in the EU, the balance is at best zero.
However, as some parameters are not taken into account in the calculation of leakage effects (energy, transport and LULUCF sector outside the EU), the related emissions are actually much higher. Europe would be responsible for an increase in GHG emissions, if the F2F and BDS targets are applied as currently defined.

CLIMATIC ASSESSMENT OF THE OBJECTIVES OF THE F2F & BDS

+ ? Mt CO2 eq.

LULUCF sector outside the EU

In the calculation of leakage effects, emissions from this sector are not accounted for. However, deforestation in non-EU countries in favour of agricultural land would be the cause of an increase in emissions. The transport and energy sector is not taken into account in these calculations either.

+ ? Mt CO2 eq.

Global carbon footprint

F2F and BDS strategies increase overall GHG emissions

Bilan Carbone Europe

F2F and BDS strategies reduce intra-EU GHG emissions.

-5 Mt CO2 eq.

The climate effects of the F2F and BDS strategies are almost zero once leakage effects and EU LULUCF are taken into account.

+54.3 Mt CO2 eq.

Leakage effects (/Kg of product)

Part of the emissions are relocated. EU production cuts lead to an increase in emissions outside the EU which are re-imported.

-59 Mt CO2 eq.

-109 Mt CO2 eq.

When only the effects of the F2F and BDS targets are taken into account, a reduction in emissions is observed. This reduction is calculated by considering only the EU emissions.

50 Mt CO2 eq.

Sector UTCATF EU

Changes in production lead to changes in land allocation in the EU that turn the EU LULUCF sector into a net carbon emitter.

V. Proposals

The objective of Europe's Green Deal is to achieve climate neutrality by 2050. In order to achieve this goal, the EC states that it is necessary to *"transform European society and economy".* The F2F and BDS strategies, which are part of the initiatives under this green pact, have been shown by numerous studies to be unable to achieve the desired results as proposed. The European and global economy as well as the well-being of societies would be strongly impacted, sacrifices that would not even allow to reach the climate objectives, since the balance would be negative, at best zero.

However, these results do not indicate that the ambitious Green Deal targets should be abandoned, but simply that a review of the proposed initiatives is required. The previous analysis has highlighted key areas where action is needed to circumvent the negative impacts mentioned, and attempt to achieve the Green Deal objectives.

Firstly, the different studies show that GHG emission reductions are entirely compensated (or even more) by leakage effects and LULUCF emissions. It is thus necessary to act on these two points to limit the losses of GHG reductions.

Regarding leakage effects, the relocation of GHG emissions to the rest of the world is largely due to the sharp drop in production in Europe. **A first response to limit leakage effects is therefore to limit production losses in the EU.** While meeting the EC's policy objectives while avoiding production losses seems to be a common sense response, the means to achieve such results are demanding.
The previous analysis allows us to identify proposals for action. In particular, it has shown a strong disconnection between the objectives proposed by the EC, but also between these objectives and the more general objective of the Green Pact. The EC has indeed set itself a climate neutrality objective, then proposed measures, and finally carried out a study to observe whether or not the proposed measures allow the climate objectives to be achieved. The results show that they do not. It seems obvious that such a reflection cannot succeed, and that it is necessary to proceed in the opposite direction. More precisely, it is necessary to start from the objective of reducing GHG emissions, to observe the solutions that exist, and to analyse these solutions with regard to the sectors that we wish to affect. Indeed, the studies have shown that the objectives proposed by the EC do not impact in the same way the different agricultural sectors, the different regions and the different Member States. In order to achieve the EC's climate objectives, it is necessary to propose specific objectives for the different agricultural sectors, regions and Member States, and not to propose general objectives whose effects cannot be controlled if they are proposed en bloc.
The same can be said for mitigation technologies. It is clear that technologies and their effects on climate are not the same within different agricultural sectors or regions.
In general, it seems necessary to propose courses of action to reduce GHG emissions according to each agricultural sector, region and/or Member State, and not to impose general measures that have not been sufficiently studied.
A study was carried out by Farm Europe, which included a measurement of the effects of the different methods, technologies and agricultural practices already available for the

different agricultural sectors. For each agricultural sector it is then possible to propose optimal courses of action, which allow environmental objectives to be achieved.

To limit leakage effects, the Kiel study suggests that it is necessary to initiate a change in dietary behaviour, including a reduction in meat consumption and the reduction of food waste. However, these objectives cannot be integrated in the same time frame as the objectives of adopting more sustainable agricultural practices. While there is a need to encourage behavioural change over a wider timeframe, it should be noted that the current F2F and BDS targets do not encourage this transition. Again, there is a need to propose coherent policy objectives, where the interdependence of all F2F and BDS objectives is taken into account, in order to avoid antagonistic effects and achieve the intended policy intentions.

For the LULUCF sector, land use changes cause large increases in GHG emissions. It is therefore necessary to control land use to limit climate impacts. These land use changes are mainly due to the four targets imposed by the EC, which force farmers to change, in most cases, not their agricultural practices, but their production and land use. To avoid these changes, it is therefore necessary to change the means of production instead. This suggests that constraints should not be imposed on farmers in the first place, but rather that farmers should be offered ways to achieve these objectives.

The F2F and BDS strategies must therefore propose specific courses of action, which achieve specific objectives and take into account the particularities of different agricultural sectors, regions and MS.

Secondly, if it is necessary to propose courses of action that really make it possible to achieve the EC's climate objectives, it is obvious that their socio-economic impacts must be limited. To achieve this, as seen above, it will be necessary not to impose binding targets on farmers but to offer them pathways and support change so that the adoption of these more sustainable means of production is effective. Support for investment must therefore be strengthened, and the benefits of adopting more sustainable farming practices must be reinforced. Imposing environmental targets on farmers without giving them the knowledge and means to do so cannot work.

Pathways of action

Studies on the performance of existing agronomic practices by agricultural sector have been carried out. Numerous studies have already evaluated and quantified the effect of various practices on farms. These studies distinguish themselves by selecting, from among these practices, those whose effectiveness on the environment and the climate is recognized, while considering socio-economic aspects.

Three sectors were studied: the wine sector, the beef sector and the field crop sector.

Summaries of these studies with concrete proposals for action are presented in the appendix (contact FarmEurope for access to the full studies). They show which levers should be favoured according to the sectors and geographical particularities.

Case of the wine sector :

The results show that while no single practice is a key solution, as all have advantages and disadvantages, some practices stand out. Indeed, with regard to the objectives of the Green Deal, the practices that make it possible to reconcile a significant reduction in GHG emissions with economic and social performance seem to be the use of **DMOs**, **contained spraying** and **varietal selection**.
As an example, **DSTs** can reduce emissions by up to 25% in the wine sector, while allowing yields to be maintained or increased (qualitatively and/or quantitatively) and reducing overall working time. The adoption of these tools is less costly, and the main challenges lie in their technical mastery and the initial investments for the purchase of related tools (weather stations, etc...).

Case of the beef sector :

In view of the results obtained in this study, it is possible to promote an efficient strategy for optimizing the reduction of total GHG emissions on the farm in an economically, environmentally and socially sustainable manner. It is built in 5 axes:

- **Aim to reduce enteric methane emissions,** by adjusting the rate of concentrates in the ration, replacing soybean meal with rapeseed meal, including additives, etc.
- **Optimize the management of effluents, with the** reduction of the storage time of the spreading, the methanization and the separation of the liquid manure, etc...
- **Enhance permanent grasslands, pastures and forages rich in legumes.**
- **Promote energy production on the farm.**
- **Optimize herd management,** by monitoring the health status of the herd, reducing the number of unproductive animals or the renewal rate, optimizing the last time between calving and slaughter, etc.