

The Promised Land: Contrasting frames of marginal land in the European Union

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ABSTRACT

Appropriating marginal land is seen as a way to overcome a wide range of land-use challenges such as food-feed-fuel competition, avoiding land abandonment, and preserving nature. As a result, there is growing interest in policy and academic communities to identify, define and measure the potential of marginal land to overcome these challenges. However, multiple definitions of marginal land exist due to the various ways of framing the problems and the solutions marginal land can address. This leads to a number of competing claims on and diverging debates about marginal land. To explore the competing claims on marginal land in these frames, we performed a framing analysis of EU policy debates about marginal land. Through this analysis, we find that different actors have conflicting ways of framing what problems marginal land can address and what courses of action to take. These frames do not overcome but form part of contested land-use debates already present in Europe. Exact definitions or estimations of marginal land are unlikely to overcome land-use debates because land-use decisions are subject to the same competing claims and hence normative decisions as land-use decisions around productive land. These marginal land frames reflect a vision for how land should be used; for food, feed, fuel or nature. We argue that exact estimations of marginal land are unlikely to fix controversies on land-use due to the inherent ambiguity of marginal land. Instead, we believe that deliberative science-policy relationships are needed.

1. Introduction

Land is a finite and scarce natural resource. Increased demands for food, feed, bioenergy and bio-based products, as well as other competing claims on land, exacerbate this land scarcity (Giller et al., 2008; Muscat et al., 2020). Land is needed, for example, to preserve habitats, regenerate ecosystems and sequester carbon to address challenges such as biodiversity loss and climate change (Bryan et al., 2016; Usubiaga-Liaño et al., 2019). This, along with other drivers such as urbanisation or infrastructure development, results in many competing claims for land and causes competition with food production. This competition, in turn, is associated with sustainability issues, such as induced greenhouse gases through land-use change (LUC) and rising food prices (Fargione et al., 2010; HLPE, 2013; Lapola et al., 2010; Timilsina et al., 2012). These interlinked challenges have led to debates about the most sustainable use of land.

Debates about more sustainable use of land in the European Union (EU) have centred on several issues. Since the 2008 food price crisis,

where biofuel production was thought to be contributing to rising food prices and food insecurity (Rosegrant and Msangi, 2014), these land-use conflicts have taken centre stage in EU policy-making. The 2008 fears surrounding the effect of biofuels on food security and development, led to discussions of moving away from food-and-feed-crop-biofuels (e.g. maize-based ethanol) to dedicated energy crops and waste-based biofuels (Michalopoulos, 2018). This was thought to avoid competition with food production and avoid food price impacts. However, controversy remained around the potential effect of these biofuels on LUC and greenhouse gas (GHG) emissions, particularly in the revision of the Renewable Energy Directive (Di Lucia et al., 2012a). Besides moving away from food-based biofuels, incentives were introduced to grow bioenergy feedstock on marginal land.

In the run-up to the release of the EU's Green Deal and the Farm to Fork Strategy, debates also surfaced about the pathways to sustainable food systems, in both science and policy. Both scientists and policy-makers debated the relationship between food consumption, livestock and land use (Foote, 2020; Kollenda, 2020). Alongside these debates,

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other trends in Europe such as land abandonment in rural areas, biodiversity loss and climate change have reinvigorated debates about the need to preserve land for rural development, nature conservation or carbon sequestration, all while avoiding competition with food production (Benayas and Bullock, 2015; Garnett et al., 2017). Such issues resurfaced particularly in the context of how to align the Common Agricultural Policy (CAP) with the Green Deal (Schebesta and Candel, 2020). Marginal land often featured in these discussions as a solution.

In response to the competition for land, making use of marginal land is often advocated as a solution to achieve these bioenergy, biodiversity or carbon sequestration goals without impacting food production (Shortall, 2013). The importance of these issues in policy agendas, both inside and outside EU institutions, has sparked academic interest in defining, identifying and testing the viability of marginal land as a solution. Despite these efforts, marginal land remains poorly or ambiguously defined (Shortall, 2013). Furthermore, formulations around marginal land can be contradictory. For example, some definitions frame marginal land as ideal for bioenergy crops while others argue bioenergy crops are not suitable for such land (Andersen et al., 2005). Definitions may focus on biophysical limitations, such as soil quality or economic limitations such as distance from key markets. Furthermore, such definitions may include many different types of land, from abandoned agricultural land to degraded land or grasslands (Shortall, 2013). This ambiguity allows for different expert communities and policy stakeholders to lay claim to marginal land as a solution (Muscat et al., 2020).

To this end, we are interested in understanding the role of marginal land at the centre of these debates by examining how different actors in science and EU policy-making frame this land. We particularly focus on the EU given its prominent role in land-use debates (Di Lucia et al., 2012b; Gamborg et al., 2012). Our aim for this paper is to better understand the multiple frames of marginal land by analysing how different actors frame both the problems and solutions surrounding marginal land.

Previous studies have highlighted the complicated assumptions that underlie definitions and spatial mapping of marginal land (Nalepa and Bauer, 2012; Shortall, 2013) and focused on stakeholder views of marginal land (Helliwell, 2018; Shortall et al., 2019; Skevas et al., 2016). However, these have so far not focused on analysing the idea of marginal land around set narratives and related these to current policy discussions. This paper, therefore, contributes to ongoing discussions about the role of ambiguity and frames in policy-making. The paper is thereby organised as follows: in Section 2, we delineate our theoretical framework focusing on the role of framing and ambiguous ideas in policy-making. Section 3 sets out the EU policy context, addressing the key policy debates in which the frames we present in Section 5 are placed. Section 4 sets out our methodological approach and Section 5 presents the results organised in eight frames surrounding marginal land. Finally, in Section 6 we discuss our results and present our conclusions. We argue that exact estimations of marginal land are unlikely to fix controversies on land-use due to the inherent ambiguity of marginal land. We conclude with a critical reflection on the marginality of land and by discussing how to deal with contested frames and ambiguity in policy-making.

2. Framing marginal land

The multiple framings and representations of marginal land that are produced by different actors reinforce the construction of land-use competition as a challenge to be governed.

The concept of frames has been utilised across several scientific disciplines, such as communication science, psychology and political science. While the exact definition of a frame can change depending on the discipline, framing in general, can be defined as the selection of 'some aspects of a perceived reality... in such a way as to promote a particular problem definition, causal interpretation, moral evaluation,

and/or treatment recommendation' (Semetko and Valkenburg, 2000), citing also Entman, 1993: p. 53). Two approaches to framing can be distinguished: cognitive framing and interactional framing (Dewulf et al., 2009). While cognitive approaches focus on mental models or cognitive structures an individual may have of a given situation, interactional framing focuses more on the communicative and discursive process by which meaning is produced (Isendahl et al., 2009). In this paper, we focus on communicative framing.

Frames can be operationalised by a frame package, which is a set of logical devices that serve as an identifier for that frame. An entire frame package can contain a core frame, linguistic devices, such as vocabulary, metaphors or images, and reasoning devices. In this study, we were primarily interested in reasoning devices. Reasoning devices are the explicit or underlying statements that connect causes with consequences in order and essentially trace out causal reasoning (Van Gorp and van der Goot, 2012). These devices can trace the cause of the problem as well as potential solutions. As sustainability policy frames largely focus on solving problems, we have chosen to focus on reasoning devices here. Because a frame package serves as an 'identity kit' for a frame, a large part of framing analysis consists in the reconstruction of these frames. Frame packages as envisioned by (Van Gorp, 2006b) are embedded within, created by and interact with cultural phenomena. As frames are related to cultural phenomena, their use as such feels so normal and natural by their user that the process of its social construction largely goes unnoticed. In this sense, a frame package, the identity kit of a frame, can act as a mechanism of power (Van Gorp, 2006a).

Frames have been shown to have a considerable impact on the policy process and the institutionalisation of ideas (Béland and Cox, 2016; Felt et al., 2007; Hannah, 2020). Particularly, the role of frames is important to understand given their 'performative power' (Beck and Mahony, 2018) in bringing about technologies, pathways or solutions into being.

Despite the many attempts to define marginal land, the concept remains elusive (Nalepa and Bauer, 2012; Shortall, 2013) and is applied in a wide variety of policy contexts. Within policy-making, ideas with ambiguous meanings such as marginal land, have been observed to serve a variety of purposes. Ambiguous ideas in policy-making have been widely studied in the social science and public governance literature under several theoretical umbrellas, particularly in the governance under complexity literature (Kovacic and Di Felice, 2019; Stirling, 2010). Ambiguity can be a problem in governance as much as serve multiple purposes. For example, ambiguous ideas may act as coalition builders (Hannah, 2020) or serve particular frames such as 'consensus frames' (Candel et al., 2014). This means that ambiguous ideas can build coalitions amongst different stakeholders when political solutions need to be found, leaving the option-space open when there is uncertainty about the appropriate technology or policy intervention (Beck and Mahony, 2018; Hannah, 2020; Kovacic and Di Felice, 2019; Stirling, 2010). Consensus frames are powerful concepts that can act as a rallying cry for collective action, even if they may hide disagreements (Mooney and Hunt, 2009). Additionally, ambiguous ideas may help find solutions in cases where science may not be able to provide clear-cut answers due to the complex nature of the problem, leading to uncertainty and incommensurability in the knowledge-base, especially when there are equally valid but competing frames and values. Such ambiguous ideas are crucial to understanding their role in finding a way out of 'wicked problems' such as land-use competition. However, they may also obfuscate inaction and ineffectiveness by giving the impression something is being done (Hannah, 2020; Kovacic and Di Felice, 2019).

Following research on uncertainty, differing frames at the science-policy interface can be due to different types of uncertainty: variability uncertainty, epistemic uncertainty (Walker et al., 2003) and ambiguity (Brugnach et al., 2008; Kovacic and Di Felice, 2019; Stirling, 2007). Variability uncertainty arises from the unpredictability of a system, which applies to complex issues such as indirect land-use change, the relationship between biodiversity and agriculture, land abandonment and sustainability of food systems. Epistemic uncertainty

relates to imperfect knowledge, which may be reduced through more and better research or better research framing. According to Dewulf et al. (2005), ambiguity emerges from different ways of framing an issue; this makes it unclear what the problem is as well as who and how it needs to be addressed. Ambiguity is therefore defined as a source of uncertainty or as a form of uncertainty itself. Ambiguity can be therefore distinguished from other forms of uncertainty, i.e. variability uncertainty and epistemic uncertainty (Brugnach et al., 2008; Klinke and Renn, 2002; Walker et al., 2003) as it emerges from cultural phenomena rather than natural phenomena or imperfect knowledge. This study, therefore, aims to find what role the idea of marginal lands plays at the science-policy interface and related to this, the type of uncertainty that may lead to differing frames.

3. EU policy and research context

Frames do not take place in isolation but often relate to wider scientific and policy discussions. The framings on marginal land found in this paper relate to four discussions which are taking place within the EU policy and research context, namely i) biofuels and indirect land-use change (ILUC); ii) the impact of biofuels on development; iii) land abandonment and rural development; and iv) livestock and sustainable food systems. See Fig 1.

i) Biofuels and indirect land-use change

The utilisation of marginal land has been suggested as one potential solution for the problem of indirect land-use change. In 2003, the EU established a biofuels policy, primarily to reduce

GHG emissions in the transport sector. Critics accused the policy of inducing both direct and indirect land-use change (ILUC). Direct land-use change is when land is converted from one use to another, in this case, for bioenergy production. Indirect-land use change is when land-use changes take place due to bioenergy production, but the land-use changes are geographically disconnected due to a complex cascade of effects. These land-use changes are associated with the release of GHG emissions and may therefore reduce the climate mitigatory effects of biofuels (Berndes et al., 2015). However, while NGOs pushed the EU Commission to ban ILUC-inducing biofuels, the biofuels industry argued that it created many jobs in European rural areas (European Bioeconomy Alliance, 2020; Kent, 2016). In 2012, the European Commission presented a legislative proposal to address some of these concerns while preserving existing investments. It proposed capping food-based biofuels and promoting advanced biofuels (non-food and feed biofuels) made from wastes and dedicated energy crops. After several years of deliberations and controversies, the revised Renewable Energy Directive (The European Parliament and the Council of the European Union, 2018) entered into force in 2018, introducing caps on food-based biofuels and encouraging incentives for advanced biofuels, especially if grown on marginal land. The directive remains a bone of contention between different stakeholders, with the bio-based industry arguing policy is too harsh and too changeable and environmental NGOs warning that not enough has been done to address the negative environmental effects of biofuels (Pilgrim

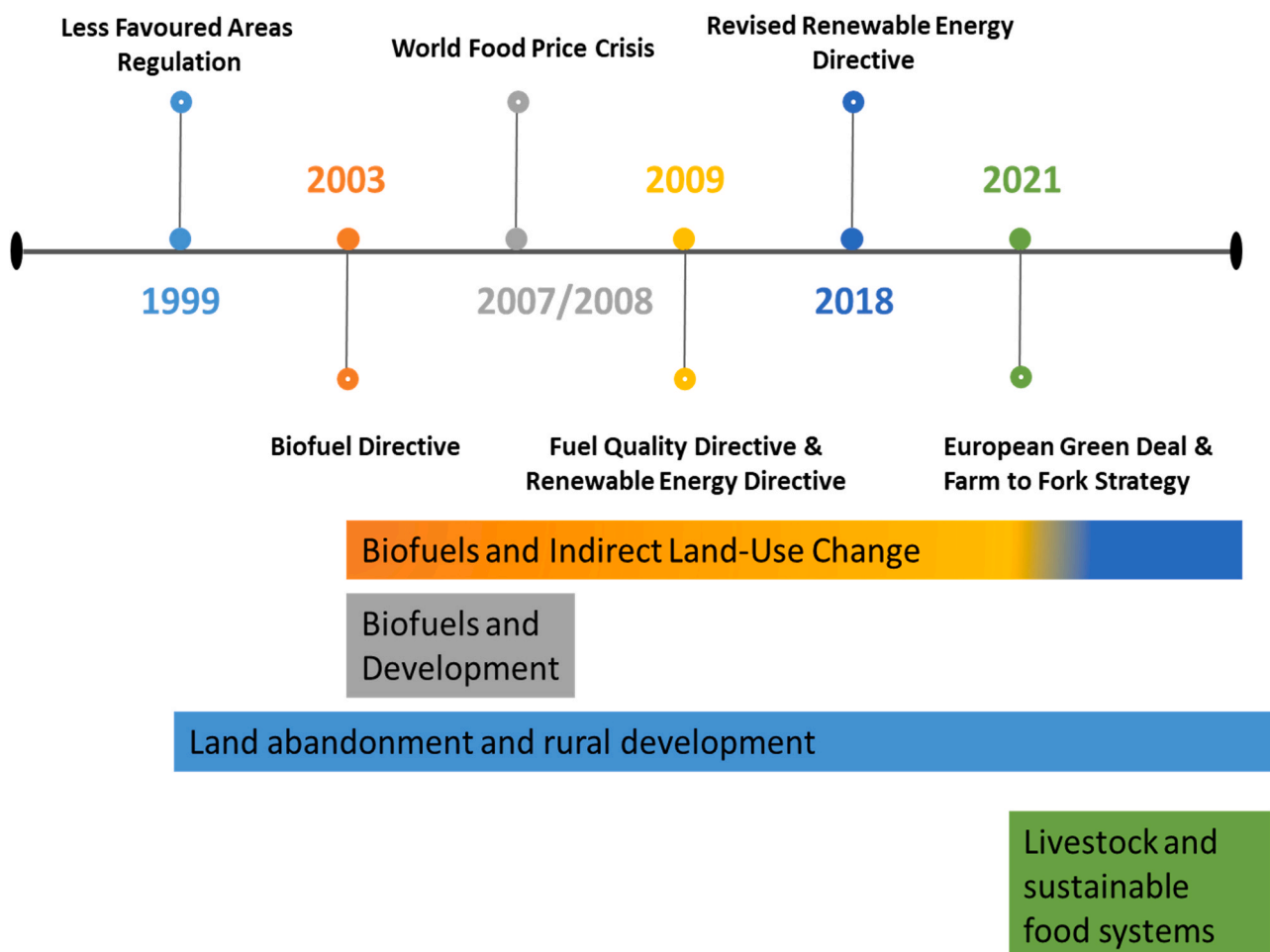


Fig. 1. Timeline of the key policy developments, the associated discussions (in the bars) and in which periods (length of the bar) these discussions were active.

and Harvey, 2010). Particularly, the question remains whether marginal land can prove to be a solution to ILUC.

ii) Biofuels and development

Another controversy surrounding bioenergy and land-use is the effect of biofuels on development, particularly on food prices, food security and rural development outcomes in low-income countries. Biofuels are thought to contribute to rural development in low-income countries by providing additional income to farmers and creating new jobs in rural areas. Incomes can be particularly improved in marginal land where lower-productivity of crop production on marginal land means lower incomes. However, the increase of agricultural commodity prices in 2007/2008 led to discussions about revisiting the EU 2003 biofuel policy and later on to the revised Renewable Energy Directive (RED) which contains caps for food-based biofuels. Many NGOs argued that there should be a complete ban on biofuels as in reality they do not bring rural development but induce a rush for land and land grabbing. While marginal land is considered a solution to avoid high food prices, some NGOs argued that marginal land is utilised to justify further land grabbing (Borras Jr et al., 2017).

iii) Land abandonment and rural development

Marginal farmland in Europe is at increased risk of abandonment. Farmland abandonment has been a key issue in CAP discussions for many years and has been discussed in both policy and scientific circles. Land abandonment refers to the abandonment of land that was previously used for crops or pasture and has multiple causes, such as areas with natural constraints limiting economic viability or economic migration to urban centres (Munroe et al., 2013). It is assumed that in the EU, approximately 11% of all farmland is at risk of abandonment (Joint Research Centre, 2018). The loss of farmland is seen as a problem given the impact on rural communities, where primary income from farming for people living in rural areas is lost, as well as traditional forms of farming which may be 'High Nature Value' (Lomba et al., 2020). High Nature Value refers to low-intensity farming systems spanning large rural areas and has become a term that is enshrined in EU policies such as the Birds and Habitats directives and the CAP. Policies and subsidies, such as Less Favoured Areas (LFAs) subsidies (LFAs-Regulation 1257/1999), have been designed to support farmers in marginal areas and prevent farmland abandonment. Others argue that European farmland abandonment in marginal land could be utilised for rewilding which may yield benefits for biodiversity (Benayas and Bullock, 2015).

iv) Livestock and sustainable food systems

Increasingly, there is an interest in food systems approaches, both in science and in policy (Fanzo et al., 2020; FAO, 2018). As part of a move towards looking at food and agricultural sustainability from a systems-wide perspective, a discussion was formed about the role of livestock, particularly concerning land-use and GHG emissions (Van Zanten et al., 2018). Marginal land in such discussions often come up as a way to bypass the high land use of livestock systems (Mottet et al., 2017; Van Zanten et al., 2018).

Within EU policies, such discussions appeared in the EU Green Deal; particularly within the Farm to Fork Strategy (European Commission, 2020) which was released in 2020 to make food systems fair, healthy and environmentally-friendly. The strategy was released in part as a response to calls from NGOs and scientists to create a common food policy that looked at the entire food system and went beyond the CAP (De Schutter et al., 2020; Schebesta and Candel, 2020). The Farm to Fork Strategy was also a result of long ongoing discussions, some of which centred around the role of livestock in a sustainable food system. The Strategy itself aims to direct consumers towards alternative proteins and strictly re-assess coupled support for livestock production, focusing only

on the most sustainable forms of livestock production. Within food systems research, livestock systems are considered as a source of competition for resources between food for humans and feed for livestock (Mottet et al., 2017). Marginal land is largely recommended as a way to avoid the effects of food-feed competition while utilising biomass from marginal land.

These discussions may in turn reflect wider paradigms and themes that characterise discussions about land, food and agriculture in general (Sexton et al., 2019; Shortall et al., 2019). In the results section, we place the frames in these wider discussions, looking at which actors utilise the frames while in the discussion we delineate how the frames reproduce wider paradigmatic discussions about land, food and agriculture.

4. Material and methods

4.1. Document selection

To better understand how marginal land is framed in debates about land use, we collected policy documents from EU institutions and other important stakeholders such as NGOs and farmers groups as well as scientific documents. We utilised the keyword 'marginal land' for all databases used. For policy and stakeholder documents, we used the EU databases EURLEX and Knowledge 4 Policy. As we were also interested in how marginal land is framed in broader EU policy debates, not just within EU institutions, we also included news articles from LexisNexis and position documents from NGOs and lobby groups, which were searched via Google. Only the first 10 pages of hits were included in the search. For scientific documents, we used Scopus as well as websites of EU-funded projects about marginal land from Google searches and snowballing technique (expanding document list by utilising references in original documents). In Scopus, we used the queries "marginal* AND land*". Only the first 200 results were collected from Scopus, as in the course of document analysis (section 3.2) no new themes were being added beyond this point. Following data saturation guidelines for qualitative research (Saunders et al., 2018), we furthermore ensured data saturation by looking for data that we may have missed by looking at key citations in the field and diversifying our list of actors. Documents were selected based on the following selection criteria: a) must form part of EU policy debates by referring to EU land issues or policies; b) must contain a full causal narrative, i.e. identifies what the problem the use of marginal land is addressing, a solution and a proposed use for the land; c) contains some definition of what is marginal/why it is considered 'available'; d) must be in English and e) must be after the year 2000. The final selection yielded a total of 82 documents across several actors (Table 1).

4.2. Document analysis

To analyse the documents, we utilised a frame package analysis (Van

Table 1

Final selection of documents. Type of documents, number of documents and source of documents.

Document	Number	Source
Scientific papers	37	Scopus
EU project communications	13	Google Search, Project websites
EU Commission Communications	12	EURLEX, Knowledge4Policy
Actor position papers	10	Google Search, NGO/Farmer's groups websites,
News Articles	6	Google search, LexisNexis, News Websites
Consultancies research reports	2	Google search, EURLEX
European Parliament Resolutions	1	EURLEX
Court of Auditors reports	1	EURLEX

Gorp and van der Goot, 2012) and analysed them in qualitative analysis software, Atlas.ti (Friese, 2012). To achieve this, we coded the documents for the problem definition (what problems do marginal land solve or not solve), what land is considered marginal, which goals can using marginal land help achieve, how can these goals be achieved (e.g. which policy interventions or agricultural practices), non-solutions (e.g. when an actor identifies a previous solution as not working) and who is making the statement. The coding structure used a combination of deductive and inductive coding through a pre-set codebook relating to the criteria mentioned above as well as emerging themes. (Fereday and Muir-Cochrane, 2006). We furthermore assessed the solutions and non-solutions to address key conflicts between frames. These were summarised in conflict matrices, which maps where frames may conflict i.e. one frame's solution is the non-solution of another. See [Supplementary material](#).

5. Results

In this section, we present the results of the framing analysis. Our analysis yielded a total of eight frames that are utilised to talk about marginal land in the European science and policy-making arena. An overview of these frames and their associated actors are presented in [Table 2](#) below. We find that the proponents of the Sustainable Bioenergy frame represented the majority of the actors. Many frames had diverse proponents, coming from both science and policy stakeholder groups. It is worth noting our search yielded a large portion of scientific papers (45%) and therefore scientists the actors most represented in this study. However, only Two frames (Marginal land Critique, Low-Cost Livestock) were used by scientific actors alone. A more detailed insight into the frames is provided in [Table 3](#). The eight frames found have different problem statements, different starting points and feed into different scientific and policy discussions. Below we describe each frame and the differences between them in turn. The frames are clustered into which wider policy and scientific discussions they feed into. Finally, we discuss the key conflicts between the frames where we look at conflicts between different solutions presented by the frames and between solutions and 'non-solutions'.

I. Frames that address the Biofuels and ILUC debate

Table 2
Breakdown of actors by frame. Number and type of actors and percentage of the total amount of actors per frame.

Frame	Who	How many (% of total actors)
Sustainable Bioenergy	EU Commission (1), EU projects (1), Scientific papers (25), Nature and Environment NGOs (4), National Politician (1), Bio-Based Industry (1), Farmer's groups (1), EU projects (4), Scientific lobby (1),	41 (60%)
Rural Development	Farmer's Groups (1), Social Enterprises (1), EU Commission (1), EU news portals (1), Scientific papers (2), European Parliament (1), Court of Auditors (1)	8 (12%)
Ecosystem Restoration	EU projects (2), Scientific papers (4)	6 (9%)
Precautionary Principle	Nature and Environment NGOs (1), Consultancies (2), Green MEP (1)	4 (6%)
Low cost Livestock	Scientific papers (3)	3 (4%)
Marginal Land Critique	Scientific papers (2)	2 (3%)
Food Security	EU Commission (1), Scientific papers (1)	2 (3%)
Land Rights	Nature and Environment NGOs (1), Land Rights NGOs (1)	2 (3%)

5.1. Sustainable Bioenergy

The Sustainable Bioenergy frame revolves around the idea that shifting bioenergy to marginal land is one of the key solutions to addressing sustainability issues such as competition with food production and direct and indirect land-use change that has plagued bioenergy in the past. This frame defines the problem as concerning the definition, assessment, and mapping of marginal land as well as the lack of its careful management. Advocates of this frame emphasised that overcoming this barrier may result in win-win-win situations, particularly in cases where marginal land is used for forest bioenergy:

"In many of our semi-natural forest ecosystems, this unused potential reduces biological diversity and increases the risk of natural disasters such as fires and wind damage. The use of forest biomass will therefore create a "win-win-win" situation because the production of bio-energy decreases the risk of forest fires and increases producers' incomes, which allows for further investments into sustainable forest management. (Joint position on the promotion of bioenergy from forests," [CEPF and ELO, 2007](#))

The narrative of unused potential for multiple benefits also applies to industrial cropping in marginal lands:

"Industrial crops can provide resources for high value-added products and bioenergy. This approach can strengthen the growing bio-based industry, help to mitigate competition in land use and increase farmers' incomes through access to new markets, as well as increasing the value of marginal land" ([MAGIC project press release, 2019](#))

The debates that surrounded the revision of the RED separated actors that advocated for a way out of these sustainability issues and those that would argue that the risk of ILUC may negate the benefits of biofuels altogether (see Precautionary Principle below). For the proponents of this frame, biofuels still have potential as a climate mitigation strategy. Actors within this frame were diverse, spanning from the EU Commission, the bioenergy industry to science and environmental NGOs. However, as our search yielded a large portion of scientific papers (45% of total), the Sustainable Bioenergy frame represents the most dominant frame across scientific actors.

The solutions recommended by this frame are largely related to income support for farmers to plant bioenergy crops such as subsidies based on the farming area dedicated to bioenergy cropping. These solutions conflict with several other frames, particularly those frames that do not consider marginal land a solution (Marginal land Critique, Land Rights) or those that want to decouple payments from crop production (Ecosystem Restoration). Nevertheless, proponents of this frame consider undifferentiated subsidies do not consider the diversity of marginal land types as a non-solution.

5.2. Precautionary Principle

The Precautionary Principle frame is careful with recommending marginal land as a solution to the problem of ILUC and argues that demand for bioenergy itself may need to be reduced along with the utilisation of marginal land. Marginal land can be a solution to land-use change problems by avoiding land that would be used for food production but proponents of this frame are quick to point out that it is a limited solution. Proponents of this frame utilise, albeit indirectly, a form of the 'precautionary principle'; a philosophical and legal principle enshrined in Treaty of the Functioning of the European Union ([European Commission, 2012](#)) that allows for decision-makers to adopt precautionary measures when scientific evidence is unclear and the problem being addressed is characterised by considerable uncertainty ([Stirling, 2007](#)). Proponents of this frame argue that given there is no clear way out of this uncertainty and that in practice biofuels have come with

Table 3

Frames about marginal land in the EU. Frames are organised according to problem definition, whether marginal lands (MGL) are considered a solution to that problem, what types of land are considered marginal according to this frame, what uses the frame envisions for marginal lands. Finally, what solutions, crops or policy instruments the frame envisions to reach its goal and what risks these may pose. Non-solutions are also presented; this is what the frame envisions as the ‘wrong’ solution. MGL refers to marginal lands.

Name of frame	Problem Definition	MGL a solution Y/N	What land is marginal	What should MGL be used for	Solution/ Crops to plant/ Policy instrument	Non-Solutions/Risks
Sustainable Bioenergy	Land-use change, indirect land-use change, land competition, lack of data, no clear definitions for marginal lands, no incentives to grow bioenergy	Yes	Abandoned land, degraded land, Contaminated land, land with economic and biophysical constraints	Growing industrial crops for bioenergy and bio-based products, afforestation for industrial uses and carbon sequestration	Area subsidies for crop cultivation, income support, tradable carbon certificates, pragmatic risk management	Undifferentiated subsidies not reflecting diversity of marginal lands; risks conflicting with nature conservation
Precautionary Principle	High demand for bioenergy, inefficient use of resources, unsustainable and risky implementation of bioenergy resulting in land-use change, indirect land-use change and land competition. Marginal land can be solution but comes with risks; the Precautionary principle should be applied.	Yes-with limitations for	Fallow land, abandoned agricultural land, degraded and contaminated land	Should be used for bioenergy if absolutely necessary and under right conditions, other uses should be explored if more sustainable	Reduce bioenergy, improve data on marginal lands, set locally targeted environmental safeguards, consider other competing uses, consider other renewables, use biomass for high-value uses	Broad and untargeted financial incentives to grow bioenergy on marginal land
Marginal Land Critique	Using MGL to grow bioenergy on an industrial scale is an inefficient and expensive way to create energy	No	Land of low productivity, economically marginal	/	/	Public incentives to maintain farmers on marginal land (risks deforestation)
Food Security	Marginal lands are where populations around the world are at risk of food insecurity. Marginal lands provide an opportunity to achieve food security by growing the bioenergy crops and providing income from farmers	Yes	Degraded land, economically marginal	Growing crops that would be productive on marginal lands	Investment in rural infrastructure and machinery	Distorted government incentives acting as barriers to investment, historical lack of investment in rural development, unbalanced food supply chains
Land rights	Marginal lands are vital resources for local communities, marginality is a myth, bioenergy on marginal land causes land grabbing	No	Does not really exist, few lands that could be used go unused	Should be used by local communities	Avoid use of MGL, Can intercrop drought-resistant crops with food crops on small scale	Planting Jatropha or other drought-resistant crops to help local communities (risks land grabbing and destruction of local habitats)
Rural Development	Land in Europe is being abandoned and this causes biodiversity loss and rural disintegration, loss of traditional modes of farming, loss of farm livelihoods, loss of tourism	Yes	Land with economic and biophysical constraints	High-Nature Value farming, Extensive farming systems and grazing, energy crops, afforestation	Direct Income support for farmers, livestock breeds adapted to harsher climates	Diverting land to international investors for afforestation, risks of land grabbing
Ecosystem Restoration	Climate change, biodiversity loss, degraded soils are threats to sustainability, marginal lands present opportunity for meeting multiple functions and provide ecosystem services	Yes	Abandoned land, degraded land, contaminated land	For ‘letting nature take over’ or for low-input farming systems or for afforestation projects	Rewilding, ecosystem restoration, low-input farming systems, afforestation, payments for carbon storage, payments for ‘abandonment’ and greening	Planting trees without taking ecosystems-level view, assuming the land must be ‘put to use’ by putting solar, wind or bioenergy, assuming extensive farming systems have more biodiversity than rewilding
Low cost Livestock	Livestock cause environmental impacts in current food systems. A lot of land is used to feed livestock. Better use of land and resources is needed.	Yes	Grassland that cannot be converted to arable land, grassland valuable for biodiversity	Grazing	Restricting livestock to biomass from marginal lands avoids food-feed competition and a more effective use of land	Focusing only on Sustainable intensification, Vegan diets may waste grazing land not suitable for crops, without grazing key biodiversity may be lost,

considerable impacts, precautionary measures are needed. The overall growth of the bio-based sector (referring to the wider bioeconomy) should therefore be kept in check:

“We cannot push for excessive growth in all bio sectors – bio-energy, biofuels, bio-based plastics and chemicals – without increasing land scarcity, competing with food supply and causing biodiversity loss”. (Eickhout, 2015)

The argument is also based on the fact that some of the envisioned benefits of utilising marginal lands may be overstated:

“the overall energy potential from dedicated energy crops on ‘spare’ land in Europe is low. While important contributions can be made to sectoral energy consumption, potential overall output looks modest even if the area cropped is larger” (IEEP, 2014)

Proponents of this frame tended to be environmental NGOs or actors with green political credentials and were often pushing the European Commission to set strict criteria for avoiding ILUC. The solutions are therefore to reduce demands that cause land scarcity in the first place, such as reducing demand for bioenergy and utilising already existing biomass for higher-value uses such as chemicals and materials rather than energy. If bioenergy cropping on marginal land still has to take place then strict environmental safeguards are needed. Similar to the Sustainable Bioenergy frame, the main non-solution is undifferentiated subsidies to grow bioenergy on marginal land.

5.3. Marginal Land Critique

The Marginal Land Critique frame outrightly rejects that marginal land could provide a pathway to sustainable bioenergy. The problem is seen to be inherent to the idea of planting crops on marginal land: growing crops on marginal land is theoretically possible but will always be too inefficient and expensive compared to growing crops on productive land. This is particularly the case for bioenergy. Critics of marginal land argue that bioenergy itself is an inefficient way to make energy on a large-scale and utilising marginal land would make it even more so. Under this definition, whether the land is marginal for economic or biophysical reasons, the planting of crops on marginal land will always entail more resources in comparison to productive land. The use of marginal land is considered inefficient for two reasons, firstly it would entail a great bureaucratic effort to monitor land use:

“Owners of land too productive for bioenergy production would have very strong economic incentives to cheat and grow bioenergy crops anyway, or to reduce the productivity of their land, to get access to the bioenergy market. There would be a need of a bureaucracy of monstrous proportions and with super national authority in order to control such a policy” (Bryngelsson and Lindgren, 2013)

And secondly, it would always be costly to use marginal land and would thus never reach industrial-level production without significant environmental impacts or economic impacts:

“the very large land requirement is hardly compatible with conversion of truly marginal land in Campania region; (v) compared to alternate land uses it does not seem an actually promising strategy to regain value from rural economy”. (Fierro et al., 2019)

Proponents of this frame who largely took a combined biophysical and economic approach, do not dismiss the possibility of planting bioenergy on marginal land but rather the possibility of it being economically viable on an industrial scale. Proponents of this frame therefore present no solutions and consider utilising public funds to incentivise farmers to plant on marginal land as a waste of resources. This frame, therefore, conflicts with the Sustainable Bioenergy frame which suggests subsidies for crop cultivation.

II. Frames that address the impact of biofuels on development

5.4. Food Security

The Food Security frame considers marginal land as an opportunity for rural development in developing countries. It is, therefore, one of two frames (see Land Rights frame below) that is primarily focused on marginal land outside of the EU. It argues that biofuels could potentially bring incomes to marginal areas with challenges in food security by providing additional income. It also argues that in the future, utilising marginal lands will be a necessity for achieving food security in developing countries in the future:

“But above all it is in Africa that the demographic will know the most spectacular leap: in 2050, the number of Africans should double compared to 2017 reaching 4.47 billion in 2100... An alternative solution is to exploit an area of about 1 billion ha of uncultivated abandoned or marginal lands situated mainly in South America and sub-Saharan Africa. These lands are home to around 1.7 billion people by one estimate”. (Hamed and Custódio, 2019)

The 2008/2007 food price crisis revealed biofuels could increase food prices and negatively affect food security, however, there was a disparity in food security outcomes between rural and urban dwellers (IFPRI-CGIAR, 2008; Kline et al., 2017). The food security frame argues that higher food prices could benefit farmers. In contrast to all other frames, this frame considers higher food prices from bioenergy as potentially good news for some rural producers in developing countries:

“Rising prices offer new income-generating opportunities for farmers and could enhance the contribution of agriculture to economic growth, although several factors may slow down this adjustment. High agricultural prices provide incentives for public and private investments and programmes to improve productivity, reinforce infrastructure, spread production to marginal land and enhance the efficiency of agricultural markets”. (EU Commission, 2008).

The problem is a lack of investment in these lands and the solution is, therefore, to find a way to make marginal land more productive by investing in infrastructure and on-farm machinery. Non-solutions are anything that may hinder these investments, such as distorted government incentives that may discourage rural producers from investing in production rather than moving towards urban centres. The Food Security frame stands in opposition to the Land Rights frame because it considers marginal land to be a pathway to development rather than a hindrance. This frame identifies the problem not as land-use competition or land scarcity but rather that populations living on marginal land in developing countries are often food insecure.

5.5. Land Rights

The Land Rights frame views marginal land as a way to obfuscate the land grabbing effects of biofuels. According to this frame, planning bioenergy crops on marginal land is unlikely to solve issues of land grabbing as marginal land is already valuable resources. The Land Rights frame is one of two frames that does not consider marginal land to be a solution to land-use competition as the frame questions the idea of ‘marginality’ itself, arguing that so-called marginal land, particularly in developing countries, are vital resources for local communities:

“Most land labelled as ‘marginal’ is in reality already being used by small-scale farmers, herders, hunters or foragers, often without official land titles. Such land provides vital functions for communities, and the loss of such land damages their food security and livelihoods”. (Friends of the Earth Europe, 2010)

The problem, according to this frame, is that the idea of ‘marginality’ itself is problematic and can cause unwanted consequences such as land

grabbing:

“International Land Coalition (ILC) calls the assumption that abundant ‘unused’ land is available a ‘myth’ often perpetuated by host governments trying to attract investors. Evidence suggests that there is very little genuinely ‘marginal’ land and that many communities have been displaced and their livelihoods destroyed” (Friends of the Earth Europe, 2010).

Proponents of this frame were from civil society organisations and were produced a counter-narrative to the story that *Jatropha* (a drought-resistant energy crop) can be planted on marginal land to produce energy, reduce carbon emissions, bring biodiversity benefits and improve rural development. Proponents of this frame did not recommend as many solutions as other frames and spent more time debunking frames that propose energy crops on marginal land. The solution recommended was to avoid using marginal land completely and instead intercrop drought-resistant energy crops next to food crops on a small-scale. This would avoid any incentives for land grabbing communal land. This frame potentially conflicts with the Food Security frame which encourages investment into marginal land areas that may cause land grabbing.

III. Frames that address land abandonment and rural development

5.6. Rural Development

The Rural Development frame seeks to improve farmer livelihoods, maintain traditional forms of farming and maintain biodiversity by utilising marginal land. It considers land abandonment and a lack of rural development to be the primary problem. Land abandonment is seen to cause biodiversity loss and disintegration of the rural fabric via young people moving away from rural to urban areas. Another problem is minimal opportunities for farmers to gain viable livelihoods on marginal land. Marginal land, on the other hand, is seen as a way to preserve traditional modes of farming and rural landscapes. In this sense, marginal land lands are seen as both the problem and the solution. The challenge of land abandonment and rural livelihoods is well encapsulated in the following quote:

“Traditional and extensive agriculture systems in areas with natural constraints and marginalised areas should be promoted throughout the EU, since they are hit hardest by the effects of land abandonment in rural areas”. (COPA-COGECA, 2020)

Marginal land should therefore be used for High Nature Value farming, planting bioenergy crops and afforestation (often for bio-based material applications e.g. furniture). However marginal lands are especially key to rural development:

“...marginal land are vital not only to ensure that these farmers remain on the land and earn a decent livelihood, but also to ensure that this land is protected and plays a role in attracting tourism to these areas” (European Parliament, 2015)

This diversity of actors is reflected in this frame as farmer’s groups, the European Commission and scientists made use of this frame. The primary solution to this is direct income support for farmers in marginal land areas and to help farmers adapt to marginal conditions e.g. through appropriate livestock breeds. The primary non-solution to this frame is for afforestation projects to be given to international investors rather than farmers. This is seen to defeat the primary purpose i.e. to ensure income to farmers for providing a service. This potentially risks land grabbing and may induce further land abandonment. This may potentially conflict with the Ecosystem Restoration frame as it recommends afforestation as a key goal, particularly if large afforestation projects are achieved through wide-scale non-farmer investment.

5.7. Ecosystem Restoration

The Ecosystem Restoration frame considers marginal land as an opportunity to deal with the global threats of biodiversity loss, climate change and soil degradation. It notes that land is being abandoned and considers this as an opportunity for rewilding and ecosystem restoration. The main aim for marginal land is therefore achieving environmental sustainability rather than rural development, though this can be a welcome effect. Proponents of the Ecosystem Restoration frame argue that abandoning land and ‘letting nature take over’ and rewilding may improve biodiversity. In this sense, it is the only frame where some actors suggested that marginal land be utilised for non-human purposes. Nevertheless, most actors in this frame suggested that increased biodiversity would also lead to benefits for humans through ecosystem services. Proponents of the Ecosystem Restoration frame reject common perceptions around land abandonment and the best use of marginal land:

“contrary to the common perception, traditional agriculture practices were not environmentally friendly and that the standards of living of rural populations were low. We suggest that current policies to maintain extensive farming landscapes underestimate the human labor needed to sustain these landscapes and the recent and future dynamics of the socio-economic drivers behind abandonment” (Navarro and Pereira, 2012)

While the Ecosystem Restoration frame takes part in discussions on land abandonment and rural development, it also touches upon wider themes of the role of agriculture in improving biodiversity. For example, it addresses the so-called ‘land-sparing/land-sharing debate’: a debate that centres around whether agriculture should either intensify production with possible detrimental effects on biodiversity or extensify production and interweave agriculture and biodiversity. Rewilding and multifunctionality of land are presented as a way to connect these two approaches.

The solutions suggested by this frame, besides rewilding, include low-input farming and afforestation to address these problems and this could be achieved through policy instruments such as payments for carbon storage or payments for farm-land abandonment. Proponents of this frame therefore consider a range of solutions, from those with no human intervention, such as rewilding to ones with greater degrees of human intervention, such as low-input farming. In terms of solutions, the Rural Development frame and the Ecosystem Restoration frame are at odds as one frame wants to pay farmers to stop abandonment and the other to increase it. This reflects calls to utilise financial support for Areas of Natural Constraints for rewilding (Merckx and Pereira, 2015) and a network of green areas and High Nature Value farms (European Commission, 2000). The Ecosystem Restoration frame also rejects the notion of the Rural Development frame that extensive farming systems typical in marginal land are more biodiverse. It also rejects the notion that marginal land is:

“a mere dormant natural resource waiting to be used, since it may provide multiple benefits and services to society relating to wildlife, biodiversity or carbon sequestration.” (Gerwin et al., 2018a)

This frame thereby rejects that land necessarily has to be used for renewable energy as a solution to climate change but argues that the aim should be achieving multiple benefits. The second difference is that while proponents of the Rural Development frame consider land abandonment to lead to biodiversity loss, the Ecosystem Restoration frame considers land abandonment to be an opportunity for ecosystem restoration.

IV. Frames that address livestock and sustainable food systems

5.8. Low-Cost Livestock

The Low-Cost Livestock frame considers marginal land as a solution to the problem of food-feed competition and as a pathway to produce sustainable animal-source food. This is largely achieved through the grazing of marginal land.

It argues that current food systems utilise resources, particularly land, ineffectively. It recognises that livestock production has so far caused considerable environmental effects. Particularly, it considers the phenomenon of food-feed competition as a key environmental issue and a misuse of agricultural resources. Food-feed competition implies feeding human-edible crops or fish to livestock and fish. It also refers to utilising land for the production of animal feed that could also be utilised for the production of human food (Mottet et al., 2017). To avoid food-feed competition, livestock should be fed only leftovers from arable cropping and biomass from marginal land i.e. grassland that is not suitable for the production of food crops. The Low-Cost Livestock frame tends to emphasise a systems-oriented view and talks of livestock within a wider food system, arguing that resource-use should be as effective as possible:

“If we want to use livestock for what they are good at, namely converting leftovers from arable and grass products into valuable food and manure, we suggest that we should no longer focus on reducing footprints of (animal) products per kg of product. ...Instead, we should focus on improving the efficiency with which livestock recycle biomass unsuited for human consumption back into the food system”. (Van Zanten et al., 2018)

The frame gains its name from the argument that livestock should be fed only with waste and leftover streams that are not edible or needed by humans and frame proponents often place themselves between two solutions to sustainability problems in food systems: those who argue for making livestock production more efficient through ‘sustainable intensification’ (Petersen and Snapp, 2015) methods (getting more food with fewer inputs) and those who argue that consumption of livestock products should be reduced. Proponents of the Low-Cost Livestock frame present themselves as a third way, arguing that both solutions are needed and that marginal land provides one way of leaving livestock in the food system while improving sustainability:

“Animal production, in its many forms, plays an integral role in the food system, making use of marginal lands, turning co-products into edible goods, contributing to crop productivity and turning edible crops into highly nutritious, protein-rich food” (Mottet et al., 2017).

As coupled support for livestock products may be questioned under the Farm to Fork Strategy, the Low-Cost Livestock frame presents itself as a way to produce livestock products while using resources sustainably. The Low-Cost Livestock frame is one of two frames along with the Marginal Land Critique frame that was only used by scientists.

The solution under this frame is to utilise biomass from marginal land to feed livestock. Grazing these marginal land is also seen to provide additional benefits, such as maintaining biodiversity. Grazing may potentially conflict with the Ecosystem Restoration frame solution of rewilding if no space for domesticated animals is left in this vision.

6. Discussion and conclusions

The use of marginal land is recommended as a way to overcome a multitude of land-use challenges. These challenges lead to a multitude of debates by both scientists and policy-makers; from the role of biofuels on land-use change to finding a balance between human use and biodiversity. However, marginal land is often defined ambiguously. Our aim for this paper was to better understand the multiple frames of marginal land by analysing how different actors frame the problems and solutions surrounding marginal land.

We found a total of eight frames, each of which defined the key problems and solutions differently and contributed to a variety of scientific and policy debates taking place in the EU. The fact that all frames had a different problem statement and addressed different debates shows the wide variability of frames being utilised around marginal land. Unlike consensus frames such as food security or sustainability, where actors agree on the goal but may differ on the course of action, the frames found here addressed entirely different goals (Candel et al., 2014). Furthermore, not all actors believed utilising marginal land is needed and even challenged the very concept of marginality. Rather it can be argued that suggesting marginal lands as a solution is presents a dominant set of frames with marginalised counter-framings. This could be due to the diversity of actors and stakeholders that utilise these frames and the ideological differences between them (Emilsson et al., 2020). For example, the Rural Development frame was utilised by farmer’s groups while the Land Rights frame was utilised by NGOs in the area of international development. The European Commission, on the other hand, featured in many of the frames, reflecting both the internal diversity between different Commission directorates but also reflecting the bridging role of the European Commission across other EU institutions such as the EU Council and the EU parliament (Skogstad and Wilder, 2019). This corresponded to the findings of Candel et al. (2014) who found that the EU Commission utilised a multitude of food security frames in the post-2013 CAP reform in order to foster public support. Another reason could be that the marginal land is a tool to achieve a goal such as sustainability, rather than a goal in itself.

Despite the diversity of frames, five of the eight frames found in this study were related to bioenergy. Likely, because marginal land as a concept was widely promoted as a strategy to overcome land-use competition between bioenergy and food production (Shortall, 2013). The Sustainable Bioenergy frame was also the frame that garnered the most attention likely because this frame largely reflects the views of the European Commission on bioenergy. The frame that came second in our study in terms of support from actors, the Rural Development frame is also supported by the European Commission and precedes the bioenergy debate by a few years. Previous studies have noted how the narratives supporting bioenergy may conflate rural development goals with climate change mitigation goals (Cadillo-Benalcazar et al., 2020). The varying support for different frames may then be explained by the degree to which actors supporting the frames approximate the central frames supported by EU policy-makers.

The fact that the differences between the frames largely stems from value-differences and ideological stances leads to a situation where multiple equally valid frames about marginal land exist. This results in a state of ambiguity, i.e. a state in which it is not clear what the problem is, who should solve it or how it should be solved (Brugnach et al., 2011). Particularly for some frames, such as the Sustainable Bioenergy frame, this ambiguity produced by both the scientific and wider EU policy communities on marginal land continue to reinforce the idea of land-use competition as a challenge that can be solved using marginal land. This is because marginal land is seen by many frames’ proponents as ‘spare’ and ‘free’ and thus not subject to the same conflicts as productive land. In other words, the uncertainty surrounding challenges such as ILUC reinforced the idea of marginal land as the solution that needs defining. Some frames, such as the Land Rights frame, challenged this idea of marginal land as spare land, but notably this frame was the frame least supported in this study and supported by actors who may have less clout in the EU policy-making process.

Currently, the debate around marginal land is deemed as a problem of epistemic uncertainty. In other words, the diverging frames are perceived to come from an incomplete knowledge of the facts. Once marginal lands are better defined and better identified or (from the opponents’ point of view) marginal lands are proved to be economically and social unviable, all actors will agree. However, from our results we conclude that it is unlikely that these debates will be resolved with more or better science alone. Solutions will also need to come from making the

various frames and their underlying values spelled out. Without this clarity, marginal land risks promising results that cannot be achieved (Shortall, 2013) or it may risk depoliticisation through the reduction of complexity (Patel, 2021).

At this point we can distinguish between the ambiguity that is needed to allow for a plurality of definitions and a forum for politics versus the type of vagueness that allows for the depoliticisation of the policy process. Vagueness in our study means asserting marginal lands as a solution, without making it explicit which marginal lands, where and owned by whom. It also ignores the values and ideologies underlying the frames by confusing misattributing the diversity of marginal land discussions to a lack of scientific agreement rather than political agreement. Vagueness in this sense allows for depoliticisation, the process by which decision-making processes are stripped of their political aspects, thereby ignoring power dynamics, values or opinions. Authors in the field emphasise that both ambiguity and vagueness can help generate consensus, but this can be negative when it frames policy solutions as 'neutral' and science-based when the science is unclear. Based on our results we draw three conclusions. First, we conclude the ambiguity characterising marginal lands is a type of uncertainty following Dewulf et al. (2009) as ambiguity that arises from different ways of defining the boundaries of the problem. In this sense, marginal land frames represent a situation of uncertainty as defined by Brugnach et al. (2008): "the situation in which there is not a unique and complete understanding of the system to be managed". With the various frames of marginal land, there was also disagreement about what exactly is to be managed: biofuels and ILUC, land abandonment, food security or biodiversity? Policy solutions will therefore likely need to be nuanced and locally adapted; for example, subsidies could both exist to preserve traditional ways of farming in areas at risk of land abandonment with rich cultural heritage (corresponding to the Rural development frame), while in some areas it might make more sense to incentive abandonment where environmental values matter more (corresponding to the Ecosystem Restoration frame). Other uncertainties are also present; for example, the uncertainty around whether biofuels on marginal land would successfully avoid ILUC led to three different frames largely due to the inherent complexity in modelling complex social and natural systems (variability uncertainty). Reviews of ILUC models show this difficulty in dealing with such uncertainty (Ahlgren and Di Lucia, 2014; Di Lucia et al., 2012a). Proponents of the Precautionary Principle on the other hand, advocated for careful management based on variability uncertainty. Proponents of the Sustainable Bioenergy frame argued for more and better research on marginal land (epistemic uncertainty). However looking across the debates, it becomes clear that marginal lands is applied to entirely different policy debates and problems. This means that ambiguity is a result of utilising a concept to address a problem when there is no complete understanding of the system to be studied (e.g. food systems or bioeconomy as a whole) or the problem to be address (e.g. rural development, biodiversity loss, climate change). This leads to our second conclusion: these frames ultimately lead marginal land-use to be subject to the same competing claims as for productive land, even though it is largely intended to avoid them. It is therefore unlikely that better definitions or accurate estimations of marginal land that attempt to reduce epistemic uncertainty will fix the problem, as they will inevitably fall into value-based and normative decisions about the best use of land. In this sense, marginal land is not 'free'. There should also be an acknowledgement that marginality is itself a deeper, underlying frame and we should recognise the inherent values of anthropocentrism and productivism in such a definition. This applied even to frames such as the Ecosystem Restoration frame, which was still based on the assumption marginal land *should* be used and any benefits from rewilding can be assessed in terms of ecosystem services. This acknowledgement of marginality as a frame is important if marginal land definitions contain problematic assumptions (Nalepa and Bauer, 2012; Shortall, 2013). Marginal land can be used to push paradigms of resource productivism that may ignore human-environment

relationships and ecosystem services that currently remain undervalued (Nalepa and Bauer, 2012) or ignore the wishes of farmers completely (Helliwell, 2018; Shortall et al., 2019; Skevas et al., 2016). The overarching frame is that if land is available it should be used (otherwise it would be wasted) and that it should be used for human purposes and/or benefit. No frame outrightly denied this assumption, even when rewilding was suggested as in the Ecosystem Restoration frame, rewilding was a way to get ecosystem services that ultimately benefit humanity.

Third, we conclude that making frames clear can be a way to deal with ambiguity by feeding them into deliberative processes in science and governance. As marginal land frames largely reproduce the contestations around land they are trying to avoid, ambiguity surrounding marginal land may need to be maintained to avoid the normative choice of some scientific facts over others, e.g. having singular definitions of marginal land that exclude its many potential uses.

How can science and policy deal with ambiguity? Some have suggested different pathways that decision-makers may take to deal with ambiguity, such as rational problem-solving, persuasion and dialogue (Brugnach et al., 2011). However, others have suggested that leaving conflicting ideas or frames ambiguous may mean no concrete path of action is determined (Candel et al., 2014) and that emphasising too much inclusivity in frame-deployment may mean actionable ideas are ignored. Losers may have to be shut out and political bargains struck (Hannah, 2020). This is particularly problematic when ambiguity blocks legal definitions from being formed and progress slowed (de Olde and Valentinov, 2019). In these cases, authors argue that difficult trade-offs ought to be made. Nevertheless, while we agree that trade-offs need to be made to reach material gains, we argue that a democratic deliberative process is needed whenever there is uncertainty due to ambiguity, rather than variability or epistemic uncertainty (Stirling, 2007, 2010). This means that making differences as explicit and transparent as possible and revealing the underlying frames and how they conflict and contrast can be part of this process. These can contribute to more formalised methods such as participatory modelling or Quantitative Story-Telling (Saltelli and Giampietro, 2017) which can explore the biophysical and economic viabilities of different frames. In EU policy-making, this could mean plural and conditional advice at critical points where science interacts with policy (e.g. EU Horizon projects, EU scientific committees and working groups).

Future policy-making will therefore have to contend with these contested visions, as without this policies may be repealed (Shortall et al., 2019). Given the EU's push for a strong bioeconomy and the revision of the Renewable Energy Directive which encourages the use of marginal land for biofuels, the continued interest in defining marginal land is likely. Multiple EU projects have already sought to define and map marginal land (Gerwin et al., 2018b; Gomes et al., 2018), which are likely to come out with conflicting outcomes. The frames also have implications for the Farm to Fork Strategy, the Biodiversity Strategy and the CAP given some of the frames' call for rewilding Europe, limiting livestock and using CAP rural development payments to support farmers and nature. While our results have shown how some frames contrast in their solutions or non-solutions, they are not necessarily mutually exclusive. The recognition that the option-space surrounding marginal land are *frames* rather than mutually exclusive 'scientifically objective' stories is the step needed to discuss what we want to do with land, whether marginal or not. In this sense, marginal land as a concept is not useful if utilised as a panacea concept to overcome wider land-use debates such as land-use change or food-feed competition.

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Conflict of interest

The authors declare they have no conflicts of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.landusepol.2021.105860](https://doi.org/10.1016/j.landusepol.2021.105860).

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