Chapter 3
New Trends and Drivers for Agricultural Land Use in Germany

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Abstract Agricultural land use in Germany is faced with new drivers and conflicts. There has been a continuous downward trend in agricultural land use since reunification, and agriculture seems to be increasingly squeezed by various land use demands. Whereas land prices and land rents have stayed rather stable during the 90ies and at the beginning of the new millennium, they have started to go up considerably during the last ten years. At the same time the agricultural sector is faced with deteriorating environmental indicators and a changing land use structure and concentration. International agricultural prices have become a key determinant for land prices in Germany contributing to increasing land prices. Equally, new demands for nature conservation and natural resource protection under the Common Agricultural Policy have contributed to make agricultural land scarcer, and bioenergy production under the Renewable Energy Act has considerably affected land demand and prices in various regions. In East Germany, some land market specialties relate to the farm structure and the land privatization process after reunification. In view of these developments, there is a new policy debate on agricultural land market interventions.

Keywords Agricultural land use · Land markets · Common Agricultural Policy

3.1 Introduction

Land is a limited and scarce natural resource faced with competing and rising demands. These demands, basically, comprise land use for agriculture, nature and natural resource protection, industrial areas and human settlements, and infras-

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tructure. Consequently, land use conflicts evolve, and these conflicts may change over time and are driven by various factors. A study by Kirschke et al. (2013) gives a comprehensive overview on land use and land use change in Europe and the main economic drivers behind, bringing together theoretical approaches from regional economics, economic geography, agricultural economics, environmental and resource economics, and infrastructure planning.

Our paper is based on these general findings and specifically looks into new developments in German agricultural land use. Are there new trends for agricultural land use change in the new millennium and, if so, what are the new conflicts and drivers?

In Sect. 3.2, we briefly sketch out the background for our discussion, addressing general land use trends in Germany after reunification. We will then discuss ongoing and new conflicts in agricultural land use in recent years in Sect. 3.3. The section focusses on rising land prices, deteriorating environmental indicators, and land use structure. In Sect. 3.4, we will look at major drivers behind this development which, basically, reflect market forces and a new policy framework. We will discuss international agricultural price developments, technological developments, Common Agricultural Policy (CAP) reforms, the Renewable Energy Act (REA), and particularities related to German reunification. Some concluding remarks are given in Sect. 3.5.

3.2 General Land Use Trends

Land use in Germany is characterized by industrial development and high population density, but also by agriculture. In the "Land use and cover area frame survey (LUCAS)", Eurostat (2012) has compared land use in EU member states. They find a higher share of human settlements and transport infrastructure in Germany as compared to the EU average. Also, the forest share in Germany (33%) is lower than in the EU (37%). However, the share of permanent grassland is somewhat higher (22% as compared to 19%), and the share of arable land is considerably higher (32% as compared to 23%).

Overall trends in land use have been similar in Germany and the EU. According to the "Coordination of information on the environment (CORINE)-Project" there has been a continuous decline of agricultural areas and a continuous increase of areas for human settlements and transport infrastructure. Table 3.1 shows a more detailed picture of land use change in Germany from 1992 to 2015/16.

According to Table 3.1, areas for human settlements and transport infrastructure have considerably increased since reunification, but this trend has come down in the recent period. This picture holds for both human settlements and transport infrastructure individually. For industrial areas and recreation areas there has been an increasing demand over the whole period whereas changing trends can rarely be identified.

Table 3.1 Absolute and relative land use change in Germany, 1992–2015/16

	1992–2000		2000–2008		2008–2015		Land use 2015 (ha)
	Hectares	%	Hectares	%	Hectares	%	
Human settlements and transport infrastructure	363,373	9.0	319,832	7.3	192,914	4.1	4,906,641
of which							
Human settlements	234,745	11.3	133,541	5.8	66,047	2.7	2,507,666
Industry	18,268	33.2	5500	7.5	26,222	33.3	104,961
Recreation	40,379	17.9	112,867	42.5	66,764	17.6	445,484
Transport infrastructure	67,680	4.1	67,229	3.9	31,812	1.8	1,810,805
Cemeteries	2,301	7.0	696	2.0	2,069	5.8	37,725
Extraction land	−8,180	−4.4	−12,696	−7.1	−11,012	−6.6	155,871
Total agricultural area	−408,408	−2.1	−338,197	−1.8	−331,346	−1.8	18,433,248
of which							
Agricultural area used	117,263	0.7	−141,633	−0.8	−266,800[a]	−1.6	16,658,900[a]
of which							
Arable land	336,019	2.9	128,991	1.1	−169,500[a]	−1.4	11,763,000[a]
Permanent grassland	−195,030	−3.7	−258,943	−5.1	−94,200[a]	−2.0	4,694,500[a]
Forest	77,858	0.7	203,477	1.9	216,569	2.0	10,951,461
Water	24,761	3.2	39,688	4.9	7,063	0.8	855,213

Source Own compilation according to Statistisches Bundesamt (2017a); [a]Data from 2016

For agriculture, there has been a continuous and considerable downward trend regarding total agricultural area. For the agricultural area used, there has been an increase in the 90ies which may be explained by adjustment processes in East German agriculture after reunification. Since 2000, however, agricultural area used is continually going down with an increasing trend. In contrast to agriculture, forest areas have increased over the whole period, with an increasing trend since 2000.

Within agriculture, interesting changes of trends for arable land and permanent grassland can be noted. Whereas arable land use has increased during the first periods considered—though with a downward trend in the second period—arable land use has considerably declined in the last period. For permanent grassland, land use has continuously declined over the whole period, though with a less dramatic trend in recent years. Indeed, a more detailed, yearly breakdown of the figures for permanent

Table 3.2 Permanent grassland in Germany, 2013–2018

Permanent grassland	2013	2014	2015	2016	2017	2018
1,000 ha	4,621.0	4,650.7	4,677.1	4,694.5	4,710.2	4,713.4
% of agricultural area used	27.7	27.8	28.0	28.2	28.2	28.3

Source Own compilation according to Statistisches Bundesamt (various years), Fachserie 3, Reihe 3.1.2

grassland shows that from 2013 onwards a slight but visible positive trend can be observed (Table 3.2).

In sum, agricultural land use seems to be increasingly squeezed between various non-agricultural land use demands. Whether or not these developments should be restricted, and if so in which way, have become popular policy topics. The German government (Bundesregierung) has claimed that the increase of areas for human settlements and for transport infrastructure should not surpass 30 ha per day until 2030[1] (it has been 63 ha per day in 2014) (Die Bundesregierung 2016, pp. 158–159). The German Farmers Association (Deutscher Bauernverband—DBV) argues that the loss of agricultural land is still about 70 ha per day and demands a legal framework for the conservation of agricultural areas (DBV et al. 2016, p. 2). Within agriculture, the increase of arable land, at the cost of permanent grassland, has equally been blamed by various actors (e.g. DAFA 2015, p. 11).

3.3 Ongoing and New Conflicts in Agriculture Land Use

The trends for agricultural land use in Germany in recent years indicate that there are both ongoing as well as potentially new land use conflicts. These conflicts will probably result in changes on land markets. In what follows we will look into the development of land market prices first, and then turn to ongoing major conflicts between agricultural land use and nature and natural resource protection. Furthermore, we will focus on land use structure and concentration in German agriculture.

3.3.1 Rising Land Prices

Despite high demand for land and conflicts between different actors, land prices have remained quite stable during the 90ies and at the beginning of the new millennium, both in Western and Eastern Germany. Since 2007/08, however, land prices have gone up considerably.

[1]The Bundesregierung recently had to shift the objective year from 2020 to 2030 (Die Bundesregierung 2016, p. 159).

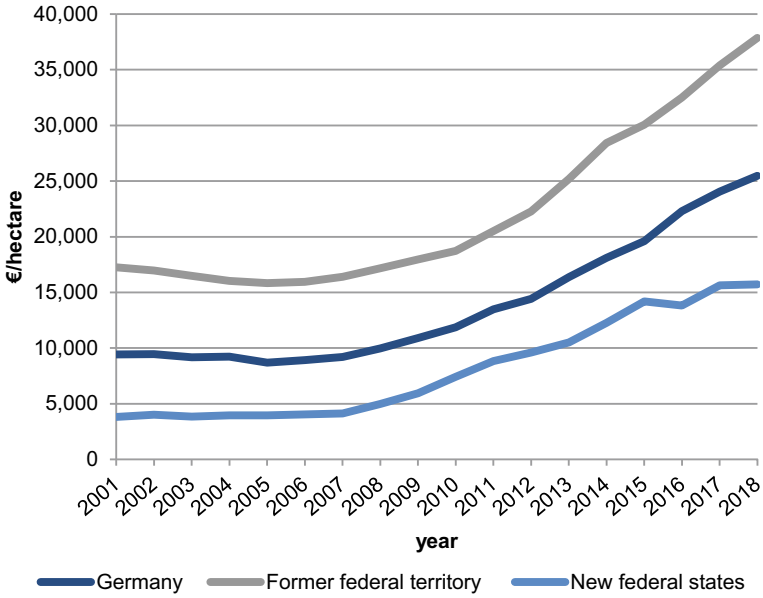


Fig. 3.1 Agricultural land prices in Germany, 2001–2018, €/ha (*Source* Own compilation according to Statistisches Bundesamt (various years), Fachserie 3, Reihe 2.4, Tab. 1.4.)

Figure 3.1 shows the development of agricultural land prices in the period 2001–2018. The figure shows average land purchase values of around 10,000 €/ha until 2007, with around 4,000 €/ha in East Germany and around 17,000 €/ha in West Germany. Since then, land prices almost doubled in West Germany and more than quadrupled in East Germany, which is a remarkable increase in a few years. Though there has been some convergence of land prices in East and West Germany in relative terms, the absolute difference has remained at around 15,000 €/ha for many years, and increased to 22,000 €/ha in 2018.

The rise in land prices is only partly accompanied by more active land markets in terms of the number of sales and the area sold. The number of sales has been around 45,000 between 2010 and 2014, with a slightly increasing trend since then. Half of this increased land market activity takes place in East Germany. The area sold has been around 40,000 ha per year in West Germany over the whole period whereas it has been around 65,000 ha per year in East Germany for many years, decreasing from 2015 to 45,000 ha in 2018.

The overall share of land market sales in total agricultural land used is rather small, with 0.7% for Germany in total and 0.3% for West Germany. However, the picture is different for East Germany: Here, the land mobility has evolved from 1% in 2004 to 1.2% in 2007, to 1.4% in 2015 and 0.8% in 2018 (Statistisches Bundesamt, various years, Fachserie 3, Reihe 2.4).

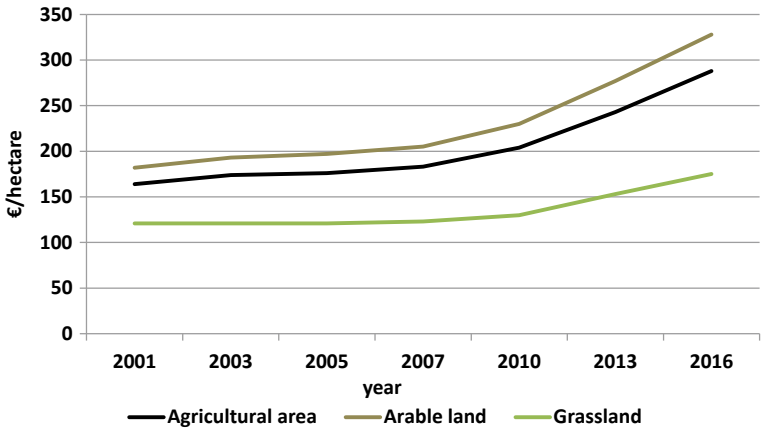


Fig. 3.2 Average land rent in Germany, 2001–2016, €/hectare [*Source* Own compilation according to Statistisches Bundesamt (2016a)]

Interestingly, the development on land markets is not correlated to the quality of land sold. The yield index, a German indicator for the yield potential of agricultural land, for areas sold has, in fact, slightly decreased over the period both for East and West Germany. There is, however, a remarkable difference in the area sold per sale. Whereas this area continuous to stay rather low in West Germany with 1.4 ha per sale, the figure has been around 4–5 ha per sale in East Germany, with increasing numbers of sales regarding areas above 50 ha (Statistisches Bundesamt, various years, Fachserie 3, Reihe 2.4).

The picture for land rents in Germany in the last decade is similar to the picture of land sales. Figure 3.2 shows that average land rents have gone up slightly until 2007, with a sharp increase in the last years. Whereas the average land rent for agricultural areas was 164 €/ha in 2001, it increased to 288 €/ha in 2016. The average rent for arable land was 328 €/ha and 175 €/ha for grassland in this year.

Figure 3.3 shows the land rent for new and renegotiated rental contracts for the German federal states (Bundesländer) during 2015–2016. The increase of rental prices is remarkable for all Bundesländer, both in East and West Germany. Whereas rental prices are of comparable size among the East German Bundesländer there is a considerable differentiation in the West German Bundesländer. Land rents are particularly high in Lower Saxony, Schleswig-Holstein, North Rhine-Westphalia and Bavaria, all of which are important agricultural regions. For Germany as a whole, in 2015 and 2016, the new and renegotiated land rents amounted to 430 €/ha for arable land, as compared to the overall average land rent of 328 €/ha in 2016. The respective figures for grassland rentals are 234 and 175 €/ha.

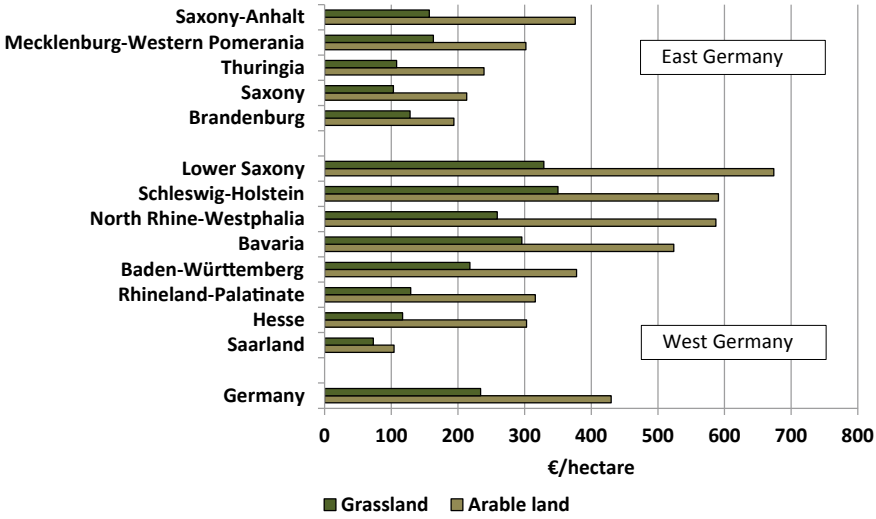


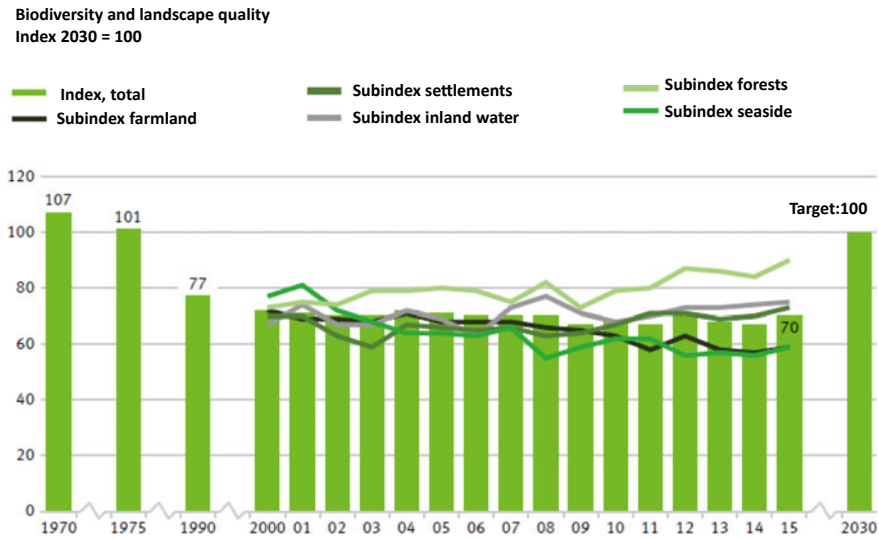
Fig. 3.3 Land rent for new and renegotiated rental contracts in German Bundesländer, 2015 and 2016, €/hectare [*Source* Own compilation according to Statistisches Bundesamt (2016a)]

3.3.2 Deteriorating Environmental Indicators

In a densely populated country like Germany with a highly intensive agriculture that accounts for a high share in agricultural land use, the conflict between agricultural land use and nature and natural resource use protection is obvious. Various environmental indicators are in place to describe the state of nature in the EU and in Germany. These indicators show that there are several problems in Germany and that the situation is not getting better in recent years but worse.

Biodiversity or rather the loss of biodiversity is among the key environmental problems. As one mayor indicator for biodiversity, the bird index was developed (Statistisches Bundesamt 2018, pp. 100–101). Using the bird index, the German government has defined a biodiversity and landscape quality indicator within the context of its "Sustainability Strategy" (Die Bundesregierung 2016). Figure 3.4 shows the development of this indicator since 2000, with a reference to reconstructed former index values in the 70ies and the target value of 100 in 2030. Based on these figures, there has been a drastic decline of biodiversity until 2000 and no improvement since then. However, a more detailed picture emerges when we look at the different land use activities individually: Whereas biodiversity in forests has improved, particularly the biodiversity on agricultural land has more or less steadily decreased. While biodiversity has come under threat from various human land use activities, the picture is particularly bad and even deteriorating for agricultural land use.

The problem of declining biodiversity on agricultural land increasingly enters the public and political debate and there is a multitude of research analyzing various aspects associated with the problem. A recent study from the German Council for



*The values for 1970 and 1975 have been reconstructed.

Fig. 3.4 Biodiversity and landscape quality in Germany, 1970–2015*, 2030 = 100 (*Source* Edited according to Statistisches Bundesamt (2018), p. 100.)

Landscape Conservation, for example, analyzes the declining common hamster population (Deutscher Rat für Landschaftspflege 2014). Further endangered species are grey partridges and hares, which are hardly seen anymore in the countryside (Adelmann et al. 2017). These are visible signs of declining biodiversity which—like the declining bird population—only mark the tip of the iceberg. It is well known that the main determinants for the partridge population decline are the lack of insects in the fields caused by insecticides and the rising pressure of predators (Gottschalk and Beeke 2014). The common hamster population is threatened by structural change and modern cultivation methods: large field plots, narrow crop rotation, use of pesticides, deep soil tillage, and unfavorable crops like maize (Adelmann et al. 2017). A recent survey on biodiversity on agricultural land is presented by Bundesamt für Naturschutz (BfN) (2017).

The High Nature Value (HNV) farmland indicator describes the quality of farmland for nature and is, thus, used to evaluate the impacts of farming on biodiversity (Peppiette 2011; Oppermann 2011). Figure 3.5 looks at the development of this indicator for Germany. In this figure, HNV I marks the highest quality of land, followed by HNV II and III. The picture shows that the aggregated indicator has gone down from 13.1% of total German farmland in 2009 to 11.5% in 2017. Interestingly, the decrease in the HNV value occurs in the HNV III class. Hence, one may conclude, that highly valued areas (HNV I and II) stay small, but are not threatened whereas less valued HNV III areas are increasingly endangered by intensive agricultural production.

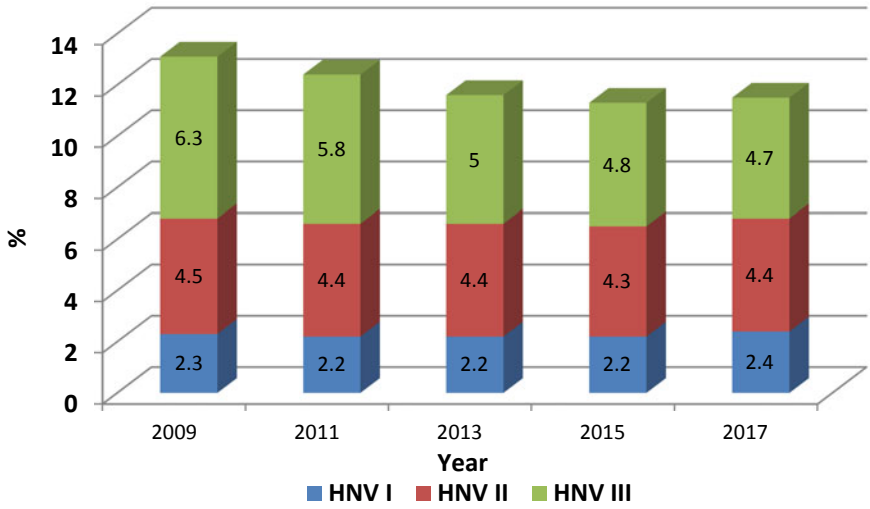


Fig. 3.5 High Nature Value (HNV) farmland in Germany in percent, 2009–2017 [*Source* Own compilation according to BfN (2018).]

The high nitrogen fertilizer use in German agriculture has caused a severe environmental problem: nitrate pollution of groundwater, surface water, and the sea. The problem is well known for years, and the total amount of nitrogen surplus on agricultural land has gone down from 110 kg/ha in 2000 to 84 kg/ha in 2014, but increased again to 102 kg/ha in 2016 (Statistisches Bundesamt 2018). Hence, the nitrate problem persists and has even deteriorated. All EU member countries are obliged to implement the Water Framework Directive (Directive W. F. 2000/60/EC) and the Nitrate Directive (Council Directive 91/676 EEC). According to the EU Commission's nitrate report from 2013 (European Commission 2013) the groundwater nitrate content has surpassed the 50 mg per liter limit at many German groundwater stations in intensive agricultural regions, and the Commission has asked for policy changes. In view of Germany's unsatisfactory reaction the EU Commission opened an infringement procedure at the European Court (Europäische Kommission 2016), and in his judgement from 21 June 2018 the Court, basically, followed the Commission's argumentation (Kirschke et al. 2019, p. 10).

Figure 3.6 shows groundwater nitrate pollution in Germany at groundwater stations of the European Environmental Agency (EEA) monitoring network. The figure exemplifies that there is no uniformly distributed nitrate pollution problem in Germany, but that some regions, typically characterized by intensive agriculture, are heavily polluted. This holds for regions in North-West Germany, the intensive arable farming regions in East Germany and the Rhine-Main area. In fact, the situation has deteriorated in many regions since 2008–2011, and this is true both for the non-polluted and the polluted areas (BMUB and BMEL 2017).

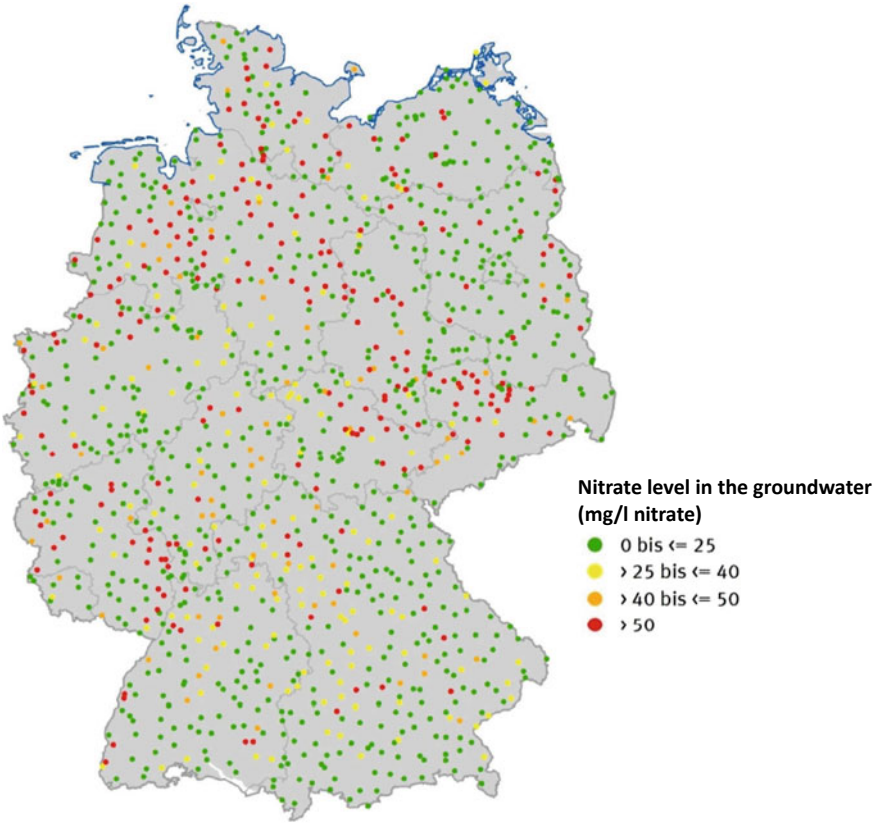


Fig. 3.6 Average nitrate levels at the measuring points (EEA monitoring network), 2012–2014 (*Source* Edited according to BMUB and BMEL: (2017), p. 45)

Hence, the nitrate problem has developed into a serious threat to society and nature. After an intensive debate the German Bundestag has finally decided upon tightening the Act on Fertilizers (Düngegesetz) (Bundesgesetzblatt 2017a) and a reform of good practice in fertilization (Düngemittelverordnung) (Bundesgesetzblatt 2017b) that govern the use of fertilizer and nitrogen fertilizer in Germany. Major new elements are e.g. fertilizer requirement statements for each plot, modified blocking periods for N-fertilizers, a limitation of nitrogen surplus on agricultural land to 60 kg/ha until 2020 and 50 kg/ha thereafter. The European Commission is not convinced that the revisions are sufficient and has requested the German government to provide proposals for a further revision; a new infringement procedure with threatening financial penalties is becoming more likely (Agra-Europe 2019). In any case, the nitrate problem will remain a key problem for agricultural land use in Germany since the revitalization of groundwater resources takes a considerable amount of time.

3.3.3 Land Use Structure and Concentration

There has been a continuous structural change in German agriculture resulting in a declining number of farms and an increasing average farm size. In 2001 the average farm size has been 28 ha in West Germany and 182 ha in East Germany (BMVEL 2002), increasing to 46 and 223 ha, respectively, in 2019 (Statistisches Bundesamt 2019). There is a new political debate in Germany restricting the access to land to avoid land concentration and non-farm land investments. In Lower Saxony the "Niedersächsisches Agrarstruktursicherungsgesetz" (Landtag Niedersachsen 2017) is to conserve structures and family-based farming and to reduce land price increases. This is an interesting new field of land use policy, however, we will not further follow up the topic since the relevance to land use seems to be limited. It may be that bigger farms and, thus, the growth of farms have an impact on the size of field plots and crop rotation, but talking about biodiversity the problem is not "big farms", but "big plots" and intensive agriculture (BfN 2015). It is widely argued that environmental problems of farming can hardly be linked to the size of a farm and, thus, the farm structure, but to the kind of farming on any farm.

Looking at agricultural land use in Germany specifically, there have been remarkable structural changes in recent years. Permanent grassland is a specific point in case. There has been a continuous decline of permanent grassland since 2000 until 2013, but since then the trend is stopped and permanent grassland is increasing. This overall picture is dominated by the situation in West Germany with a share of permanent grassland of 76% in 2016 whereas the area of permanent grassland has stayed roughly the same in East Germany from 2004 onwards. The West German picture is reflected by Bavaria and Lower Saxony, which are the German Bundesländer with the largest area of permanent grassland. In Bavaria the downward trend, with 1.15 million hectares in 2002, seems to be stopped in recent years, with 1.06 million hectares in 2016. In Lower Saxony, the figures are 0.78 million hectares in 2002 and 0.69 million hectares in 2016, respectively (Statistisches Bundesamt, various years).

Some remarkable land use changes can also be stated for arable land in Germany since 2000. Figure 3.7 shows land use changes between 2004 and 2019 for the main crops farmed in Germany. With a share of 55% in 2019 cereals cover most of the arable land in Germany. In recent years there has been a downward trend in cereal land use contrasted by a stable trend for wheat. A downward trend can also be noted for root crops (potatoes and sugar beets) with an increase to 680,000 ha in 2019 whereas there has been a remarkable extension of the silage maize area since 2010. Additionally, some trends for minor crops are worth mentioning. The total area farmed with pulses decreased to 92,000 ha in 2014 but doubled within two years with 196,000 ha in 2019. Set-aside land has been coming down from 939,000 ha in 2003 to 147,000 ha in 2019.

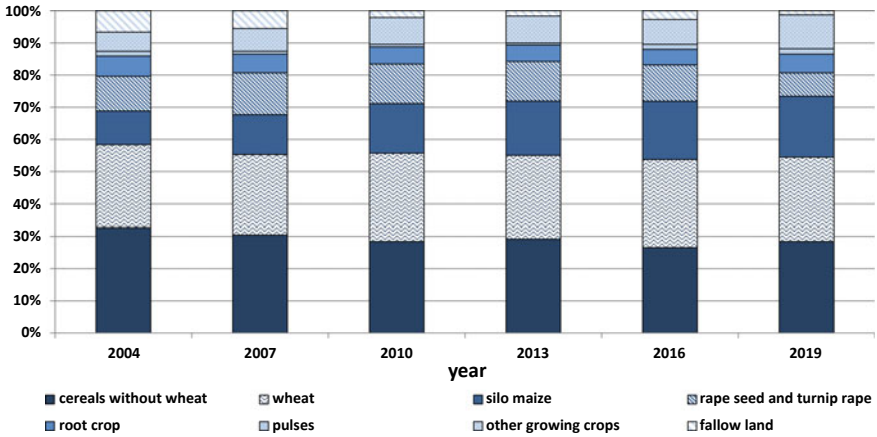


Fig. 3.7 Use of arable land in Germany, 2004–2019, in % (*Source* Own compilation according to Statistisches Bundesamt (various years), Fachserie 3)

3.4 New Drivers

Recent agricultural land use trends in Germany indicate that land use conflicts are increasing. An obvious indication for this development is rising land prices pointing to increased demand for land both within and outside agriculture. The traditional conflict between agricultural production and nature and natural resource protection did not diminish, but rather deteriorate. New trends in the agricultural land use structure both reflect changing demand for land within the agricultural sector and seem to underline the conflict between agriculture and environment. Interestingly, some of these trends (permanent grassland, pulses) seem to have been reversed in recent years. What are the new drivers behind these developments?

3.4.1 Market Forces

In a market economy agricultural production and agricultural land use basically depend on prices. The relationship between commodity and factor prices, and land prices in particular, has been a well-known and analyzed topic in agricultural economics. Since land supply is fairly inelastic, changes in land demand have a major impact on land prices. High commodity prices translate into higher demand for land and other factors and, thus, result in higher land prices and intensification.

Figure 3.8 illustrates the theoretical aspects showing how an increased commodity price e.g. for wheat changes land prices and affects the nitrogen market. On both factor markets, the higher commodity price shifts the marginal value product function to the right showing the increased demand for production factors. For simplicity, land

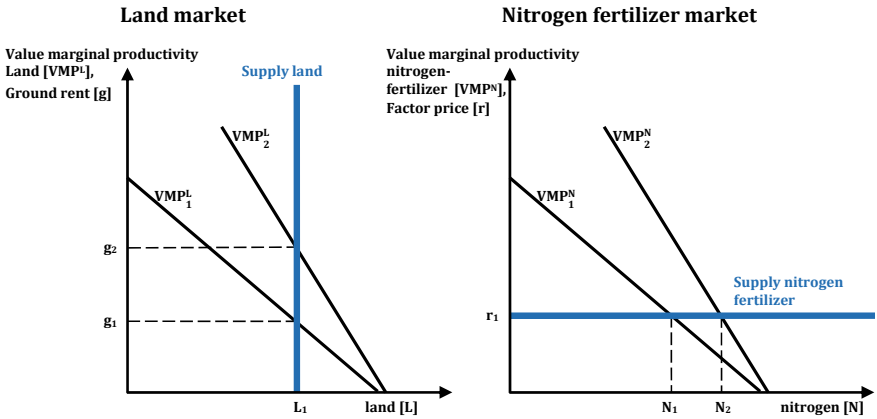


Fig. 3.8 Impact of rising commodity prices on factor markets (*Source* Own compilation.)

supply is shown as a totally inelastic supply curve in the figure whereas nitrogen supply is supposed to be totally elastic. Hence, the commodity price increase results in a high increase of the land price with no impact on land use whereas nitrogen use increases with a constant nitrogen price. Consequently, nitrogen intensity, defined as nitrogen use per hectare, increases.

The importance of commodity prices for land prices (and agricultural intensification) has been broadly discussed in the literature. The EU's protectionist agricultural policy of the past has certainly contributed to higher land prices as compared to free trade conditions whereas the liberalization of this policy during the last two decades would have had the opposite effect under the historical framework conditions. However, this framework has changed and the major factors for a new increased demand for land relate to the introduction of direct payments, tied to land, and increasing world market prices. Today, with liberalized EU markets and domestic prices driven by world markets and no longer by a protectionist policy framework, international agricultural prices and their changes have a crucial impact on land prices in the EU and Germany.

International agricultural prices have, in fact, been going up in recent years with a well-known price boom in 2007–2008. Whereas a long-term decreasing price trend could be observed on international agricultural markets in the past (Tyers and Anderson 1992, p. 49), this trend seems to be reversed for the future (European Commission 2011, p. 49). The Food and Agriculture Organization's (FAO) food prices index shows a clearly increasing trend in the new millennium and the Organization for Economic Co-operation and Development (OECD) and FAO expect stable and even increasing price trends for agricultural commodities in the future (OECD/FAO 2016).

Figure 3.9 shows the average producer price index for German farmers from 2000 to 2018. After the liberalization of the EU's CAP agricultural prices in the EU are widely determined by international prices. This is visualized by the price trend in

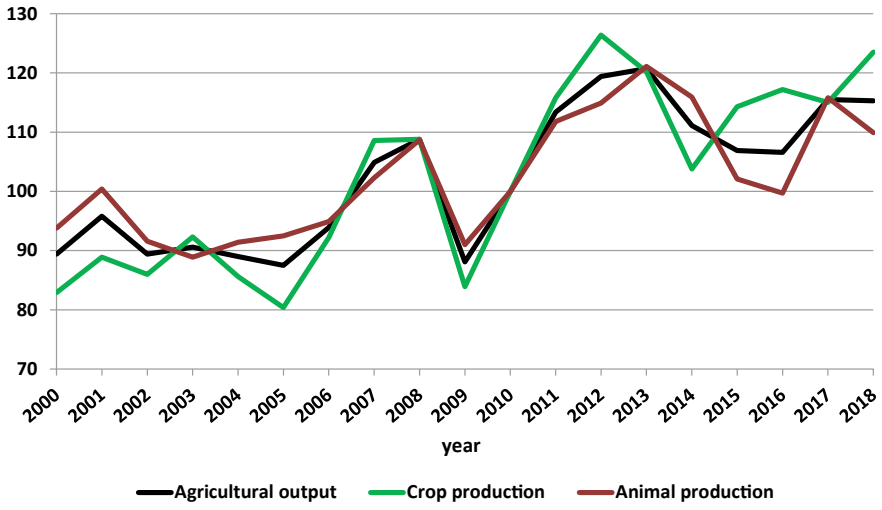


Fig. 3.9 Agricultural producer price index in Germany, 2000–2018 (2010 = 100) (*Source* Own compilation according to Statistisches Bundesamt (various years), Fachserie 17, Reihe 1.)

Fig. 3.9. Hence, international agricultural prices have become a major determinant for land prices in Germany and will be so in the future contributing to stable and, possibly, increasing land prices.

The demand for agricultural land certainly reflects the development and the competitiveness of the agricultural sector, but increasing land prices also reflect the demand from non-agricultural sectors. We have argued that the demand for land for human settlement and transport infrastructure remains to be strong, and this is certainly a "pull factor" for land prices. Some interesting new "pull factors" have become the demand for land for nature conservation and natural resource protection and bioenergy production, but since these demands are clearly policy-driven, they are discussed in the following chapter.

There may be some additional factors contributing to rising land prices, but relationships are less obvious. Farm succession has, generally, been considered a problem in times of decreasing agricultural prices, but times seem to change, at least in some regions. There is some indication that the taking over of farms by young farmers is connected with farm growth and increasing land demand, e.g. in Bavaria (Statistische Ämter des Bundes und der Länder 2011). Additionally, investment into agricultural land becomes attractive for investors outside the agricultural sector. Such a development has been observed for East German agriculture, even though this development cannot yet be considered as a major new trend (Tietz 2015). Low interest rates caused by the European Central Bank's monetary policy might actually support this development.

It is a well-known debate in agricultural economics that technological progress and increased productivity contribute to a higher demand for land and, thus, rising land prices. These "pull factors" for land markets continue to be relevant since new

technologies are often linked to economies of scale and larger plots, e.g. in the case of precision farming and efficient fertilizer use. An interesting point in this regard is that a reconciliation of farming and nature protection might require appropriate large scale and expensive technologies, thus, contributing to structural change (Schaft and Balmann 2010). It is an open question whether such incentives for large-scale farming might have an effect on land market and prices.

New technological developments might actually reverse such trends. Interesting ideas relate to the miniaturization of agricultural technologies like small harvesters and to ongoing digitalization of farming e.g. drone technology (ATB 2017). In fact, such technological options might allow for competitive farming on smaller agricultural plots, thus, counteracting the need for large-scale farming and structural change.

3.4.2 Policy Framework

There is no question that demand for agricultural land is highly policy-induced in Germany and the European Union. The former protectionist CAP has contributed to rising farm prices in the past whereas the liberalization of this policy had the opposite effect. Furthermore, direct payments as introduced with the MacSharry reform certainly contributed to rising land prices. Such impacts of price policies and direct payments have been well analyzed and documented in the agricultural economics literature (Offermann et al. 2012; Hennig et al. 2014).

In addition, a new feature of the CAP may have had an impact on land use and on land markets and prices. For the financial period 2014–2020, the EU has decided upon a new CAP framework and a major feature of this is the "greening" of direct payments. Farmers can receive 30% of direct payments if, and only if, they fulfill certain land use requirements: Arable land use must comprise a minimum number of crops, permanent grassland is to be maintained, and 5% of arable land has to be Ecological Focus Areas (EFA) (European Parliament and Council 2013, Article 43). Despite such obligations, the general implications for agricultural land use seem to be limited. Due to major exemptions (small farms, grassland farms) only 52% of the EU agricultural land is affected by the EFA obligation (Pe'er et al. 2014), and the minimum number of crops required on arable land hardly impacts land use (BfN 2017).

However, the requirement to maintain grassland use certainly will have an impact. In Germany, the downward trend of permanent grassland use in the past seems to have stopped and this is most probably due to the restrictive CAP policy framework already existing in the preceding financial period and the restrictive greening regulation since 2014. Hence, if regulations stay the same we expect the area under permanent grassland to persist in the future.

The EFA framework will also have an impact on arable land use. Figure 3.10 shows the use of EFA in the German Bundesländer in 2015. According to the figure most of this area has been used for cash crops. This may have beneficial effects for

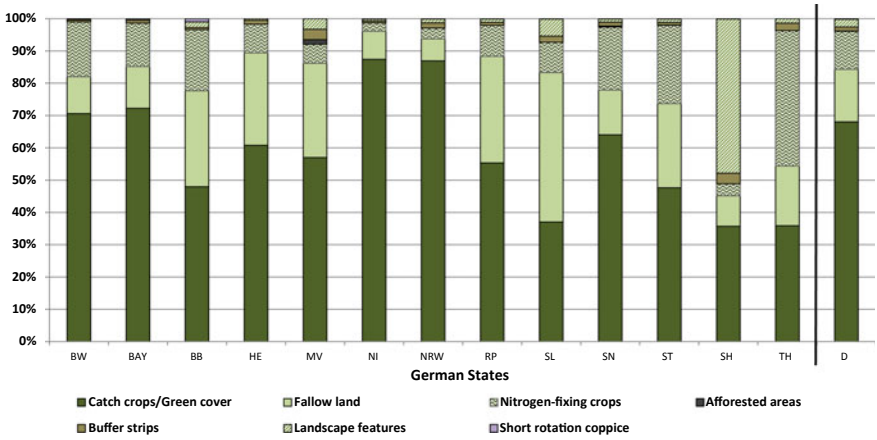


Fig. 3.10 Use of Ecological Focus Areas in Germany, 2015 (*Source* Own compilation according to Lakner et al. (2016).)

soil and groundwater, but biodiversity is hardly affected. Set-aside land, on the other hand, is certainly positive for biodiversity, though the area is limited. An interesting new development is to use pulses on EFA (Fig. 3.7), which explains the revival of pulses production in Germany in recent years. This example shows how land use may more be affected by the policy framework than by comparative advantage.

Summing up, the new greening regulation under the CAP certainly has an impact with respect to permanent grassland and pulses, but the overall land use implications are limited. In particular, the greening regulation will hardly contribute to alleviating the conflict between agricultural land use and nature and natural resource protection. Consequently, the greening regulation is a rather inefficient instrument to enhance biodiversity and ecological objectives (Pe'er et al. 2014; BfN 2017). On the other hand, greening contributes to making agricultural land scarcer, thus, impacting on land markets and prices.

The specific feature of the German REA is to support various types of renewable energies like wind and water power, solar energy, and bioenergy by guaranteeing sale and prices of the electricity produced. The production of biogas has become an important activity field for German farmers: From 2000 the installed electric output of biogas plants in Germany increased from 65 megawatt to 1,377 MW in 2008; it jumped to 3,905 MW in 2014 and 5,228 MW in 2019, respectively. In recent years installation somewhat stagnates on this high level due to corrections of the REA and reduced incentives (Statista 2019).

This development has led to a remarkable land use change in German agriculture. Since silage maize has proven to be the most profitable crop for biogas production, the area of maize production has increased considerably. It amounted to 1.2 million hectares in 2003, increased to 1.6 million hectares in 2008 and was about 2.2 million hectares in 2019. This increase in maize production area is not evenly distributed all over Germany, but maize production is concentrated in some regions

like North-West Germany (Lower Saxony 24%, North Rhine-Westphalia 10%) and Bavaria (21%) (Statistisches Bundesamt 2016b). In some regions the maize production share amounts to more than 45% of agricultural area used. The reasons for this local concentration relate to animal production (and, thus, to liquid manure use), technological synergy effects, and opportunity costs in agricultural production (Scholz 2015; Breustedt and Habermann 2011). Hence, this new development in agricultural land use is clearly (energy) policy-induced.

The increasing "Vermaisung" (increasing maize cultivation) of the countryside has been analyzed and criticized from various sides. Maize cultivation has led to reduced crop rotation and to monoculture tendencies, which is counterproductive from an agronomic point of view and a threat to biodiversity from an ecological point of view (Linhart and Dhungel 2013). Within the agricultural sector, the biogas boom has led to new income opportunities for some farmers (and for non-farm investors), but it has also influenced the competitiveness between farms and production orientation. E.g., the opportunity costs of milk production have increased in some regions due to competition for the same production factor: maize. More generally, the increased land use for biogas production has contributed to higher land prices, thus, increasing cost of production for agricultural production. Various studies have shown this land market effect of maize cultivation and biogas production (Hennig and Latacz-Lohmann 2017; Bund-Länder-Arbeitsgruppe 2015; Breustedt and Habermann 2011). An interesting side effect of the increased maize cultivation area is the potential effect on the wild boar population (Hahn 2014).

Additional competition on land markets may also be caused by demand for wind power installations. The profit of wind power installations has been calculated to be around 9,000 €/ha/year (Ritter et al. 2015). Direct land requirement for wind power installations is in the range of 200–400 m^2 per unit, supplemented by additional indirect land requirements for distance and compensatory areas. In 2018, the total number of onshore wind power units in Germany amounts to 29,213 (Bundesverband Windenergie 2018). The effect of wind power installations on land price increases in Brandenburg has been calculated to be 5% (Ritter et al. 2015).

A German land market specialty is the privatization of land in the East German Bundesländer after reunification. In the former German Democratic Republic the state owned 2.1 million hectares (almost a third) of agricultural land that was to be privatized after reunification. The Bodenverwertungs- und -verwaltungsgesellschaft (BVVG) was created to guide and to carry out the land privatization process. At the beginning the BVVG favored long-term leasing of land; land sales started in 1995. A part of the land privatization took place in accordance with the rules of the EALG (Entschädigungs- und Ausgleichsleistungsgesetz). Until 2009, entitled persons (tenant farmers and previous owners) could buy land at special conditions (35% under market value) (Jochimsen 2010). In 2007, the BVVG fundamentally modified the guidelines of privatization: The principles now are call for tender and sale to highest bidder. Since 1992 a total of 869,100 ha of agricultural land have been privatized, of which 80% were sold to local tenant farmers, and 51% were sold under the rules of the EALG (16% to previous owners, 84% to tenant farmers) (BVVG 2018). The still possible EALG-sales to previous owners will end in the foreseeable

future. It can be argued that land prices in East Germany would have increased faster in the past without the former EALG privatization rules.

There are now concerns that the recent BVVG land selling prices are higher than the non-BVVG land sales, probably for all new Bundesländer and particularly for Saxony-Anhalt. There is an increasing debate whether the new BVVG privatization guidelines contribute to the rising land prices in East Germany. The changed land privatization process with public tender has led to increased market transparency and, possibly, to a new interest of non-agricultural investors in land by reducing market entry barriers (Hüttel et al. 2015). In a recent study for Brandenburg, increasing activities of non-agricultural and non-regional investors on land markets have been identified (Agra-Europa 2017), but there is no comprehensive overview on such new developments on agricultural land markets in East Germany so far. Balmann (2015) argues that the BVVG land activities basically enhance market transparency and contribute to market efficiency. Hence, the fragmented land market in East Germany rather reflects "market prices" for BVVG land sales whereas non-BVVG land sales might be influenced by inadequate information, non-economic interests, or market power of local big farms. Hence, the change of the BVVG land privatization guidelines has certainly an impact on land markets, but a specific price increasing effect in recent years can hardly be identified. Generally, Tietz and Forstner (2014) argue that the rising agricultural land prices in recent years basically reflect market forces and do not point to a speculative bubble.

It is also true that BVVG land sales mark a considerable share of overall land sales, e.g. amounting in 2015 to 35% for the East German average and to even 57% for Mecklenburg-Western Pomerania (own calculation according to BVVG, various years, and Agra-Europe 2016). The BVVG privatization system is scheduled to end in 2030.

There is no doubt that land mobility has increased considerably in East Germany in recent years (Sect. 3.3). However, this is not entirely reflected in official land statistics. The official figures will rather be lower than real activities on land markets since shareholder changes in legal entity farms affect land allocation, but not official statistics. Tietz (2015) estimates that such shareholder deals surpass the statistically documented land mobility by about 20%. Hence, one may argue that non-agricultural and non-regional land investors contribute to higher land mobility (Emmann et al. 2015).

Summarizing this chapter the political framework certainly had and will continue to have an impact on land markets and land price developments. New demands under the CAP have contributed to make agricultural land scarcer and the REA has considerably affected land use in various regions. In East Germany, there are some specialties related to the farm structure and the land privatization process under the BVVG.

3.5 Conclusions

Recent developments regarding agricultural land use and land markets in Germany show that land has become an increasingly scarce natural resource faced with competing and rising demands. The general picture is that agricultural land prices have gone up considerably and there are ongoing and accentuated as well as new conflicts. Basic conflicts refer to agricultural land use in competition to nature and natural resource protection as well as to new demands on agricultural land use related to bioenergy production. Key drivers are international agricultural markets and prices as well as changing policy frameworks related to the CAP and to the REA.

What kind of policy conclusions can be drawn? First, the scarcity of a limited natural resource like land has to be recognized and can hardly be changed. This requires proper policy-making between market efficiency and policy intervention. Second, policy-making should generally avoid contributing to land scarcity and enhancing land use conflicts. The support of bioenergy production under the REA is a point in case: There may be better ways to achieve renewable energy objectives instead of directly enhancing land use conflicts. Also, indirect and international land use effects should not be neglected in national and EU policy-making in order to contribute to a proper global land use between food and energy production and nature and natural resource protection. Third, interventions on land markets will become a key policy issue. There is an increasing debate in Germany and notably in East Germany on land market interventions. Various political claims have been put forward such as the transparency on agricultural land ownerships, authorization for share deals, and the establishment of a public fund for land (Agra-Europe 2017). It needs to be questioned whether such political ideas are worth to be pursued, but finding the right answers to the real problems on land markets is a key challenge for the future.

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