Chapter 13

‘The hottest summer ever!’

Exploring vulnerability to climate change among grain producers in Eastern Norway

‘The hottest summer ever!’

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This chapter revisits tensions between Norway's image as a climate-resilient society and the reality of vulnerability among farmers in Eastern Norway. Over the past decade, farmers in Eastern Norway have introduced various measures to adapt to climate variability and extreme events related to heavy rain. The summer of 2018, however, represented an unusual challenge – it was an ‘extreme’ extreme event of prolonged heat and very little rainfall. New records were set, with May temperature 5°C–6°C above average. Neither farmers nor institutions in the farming sector were prepared for the vulnerability made visible by the summer of 2018. According to climate models, the probability of similar summers in the future has already doubled and will continue to increase as emissions rise. In the chapter, we discuss some key insights based on farmers’ experiences in 2018. We first explore the uneven impacts and differential responses among grain farmers in Eastern Norway, both individually and collectively. We then consider the extent to which responses to ‘the hottest summer ever’ in Eastern Norway were transformative, assessing them in relation to the practical, political, and personal spheres of transformation. Finally, we consider some implications of this changing vulnerability landscape for the future. This study shows the importance of institutional responses and a culture of cooperation in reducing vulnerability, and it draws attention to the importance of linking environmental risks with the social, economic, and political processes that are contributing to vulnerability in the first place.

Introduction: The changing landscape of vulnerability

‘What makes people vulnerable?’ This question, posed by Hilhorst and Bankoff (2004, 1) in the introduction to *Mapping Vulnerability: Disasters, Development and People*, is a critical one to consider if we are interested in a sustainable and resilient future. Although there is a logic and appeal to the current focus on adaptation and resilience, without an understanding of the root causes and drivers of vulnerability it becomes easy to promote resilience and adaptation within the very systems that are contributing to vulnerability in the first place.

Understanding the multiple dimensions and dynamics of vulnerability is a prerequisite for transformative responses to risk reduction.

Hilhorst and Bankoff (2004) offered a nuanced answer to the question of what makes people vulnerable, pointing out that at one level it is about poverty, resource depletion, and marginalisation, and at another level about the diversity of risks generated by both local and global processes. Alluding to the changing nature of disasters, they called for attention to the dynamic interactions and linkages that generate destructive forces. They also reminded us that vulnerability is about people and their ideas, perceptions, and practices in relation to risk and disaster (Hilhorst and Bankoff 2004, 4). To reduce vulnerability in practice, issues of empowerment, capacity, local participation, and organisational strengthening were recognised as vital (Frerks and Bender 2004).

More than 15 years after the publication of *Mapping Vulnerability*, the question of what makes people vulnerable must be examined within the context of accelerating global change. Climate change is shattering temperature records, disrupting rainfall patterns, and normalising extreme weather events, and there are increasing concerns about feedbacks in the climate system that could trigger tipping points leading to a 'Hothouse Earth' scenario (Steffen et al. 2018). Environmental changes have been transforming vulnerability landscapes for many households, communities, sectors, and social groups. Despite significant attention to strategies and actions to promote adaptation and resilience, millions of people experience vulnerabilities linked to multiple and interacting stressors, including those related to extreme weather events and climate-related hazards (Leichenko and O´Brien 2019).

The vulnerability landscape is becoming deeper and more extensive than many experts anticipated two or three decades ago, and we are moving into unknown territory. For example, an increase in bushfires in Australia has revealed that there is little knowledge on which subgroups of the population are most vulnerable to the long-term effects of smoke (Yu et al. 2020). Increasing exposure to heatwaves in European capitals may impose greater risks for urban residents who are elderly, young, isolated, or with pre-existing chronic conditions or mental disorders, as well as communities with weak socioeconomic status (Smid et al. 2019). Case after case reveals that the dynamics of vulnerability are closely tied to economic, political, and social challenges, including a growing concentration of wealth, dissatisfaction with and a backlash to current forms of democracy, economic uncertainty, and the risks associated with global pandemics (Piketty 2020; Ribot 2014).

Many groups and communities that have felt complacent about their resilience and adaptive capacity are increasingly confronted with climate change impacts that are intertwined with other social, economic, and ecological dynamics. There is a growing awareness that actions must be taken to reduce risk to multiple, interacting stressors. Yet is there any evidence that approaches to vulnerability reduction are transforming as quickly as the vulnerability landscape? To engage with this inquiry, we explore what vulnerability looks like and how it is perceived by those who generally consider themselves to be resilient to variations and extremes in weather and climate, namely farmers in Eastern Norway.

Norway is a country that is widely considered to be resilient to climate change based on its wealth, education, infrastructure, access to resources, and management capabilities, i.e., the factors contributing to high adaptive capacity at the national level (O'Brien et al. 2004; Sarkodie and Strezov 2019). However, such conceptualisations of resilience are dependent on perceptions of risk, vulnerability, and adaptive capacity, which are often challenged when vulnerability is seen through an integrated, multi-scale lens (O'Brien et al. 2006; Slovic 2000). The extremely hot summer of 2018 in Norway provides an opportunity to study the current discourse on vulnerability among farmers in Eastern Norway, a region that accounts for 80 per cent of the country's grain production. The 'hottest summer ever' was experienced in a region that has seen average temperature increases of about 1°C over the past 30 years. In 2018, the drop in production of grain and grass by about 50 per cent led to a dramatic reduction in farm-level income, and a wide range of consequences and responses. In this chapter, we investigate the following:

- What were the consequences of the drought at the farm level?
- What responses can be identified at the farm level?
- How did the institutions in agriculture respond to the drought?

The implications of different responses will be discussed in light of the transformative changes needed to reduce risk and vulnerability across local, national, and global scales.

We begin by describing the 'hottest summer ever' and its impacts on Norwegian agriculture. We then draw on interviews with farmers about their ideas, perceptions, and practices related to vulnerability in the aftermath of the summer of 2018, with attention to the uneven impacts and differential responses among grain farmers in Eastern Norway. We relate these responses to the practical, political, and personal spheres of transformations (O'Brien 2018). Our results show that most of the actions taken by farmers to reduce vulnerability involved technical and

behavioural responses that fall within the practical sphere. Yet in many cases, these responses were facilitated by structures and systems related to the political sphere of transformation, including cultural norms and formal and informal institutions. However, one important driver of transformative change for reducing long-term global vulnerability was notably absent: some farmers do not believe that climate change is a risk, and few linked vulnerability of agriculture to the perpetuation of an oil-based, consumption-oriented economy that is contributing to increased risk and vulnerability at a global scale. A sense of complacency supports technical responses over deeper and more extensive transformations that could address the long-term vulnerability of farmers in Eastern Norway and elsewhere in the world.

We draw on an extreme case in a wealthy country that is considered 'resilient' to climate change because it provides an important perspective on the evolving vulnerability landscape. Moreover, it can also offer important insights on the types of transformations that may be needed to reduce vulnerability. Our study makes use of data on agricultural production and applications for public drought relief available from Statistics Norway, together with weather and climate data from the Norwegian Meteorological Institute. However, there are no statistics available on how farmers coped with the drought and possible strategies to prepare for future climate extremes. To understand how vulnerability to climate change was experienced by farmers, we interviewed a limited number of farmers and read about 100 newspaper articles on the drought. In addition, one of the authors operates a small grain farm in Eastern Norway and directly experienced the drought and its consequences. He took part in formal and informal conversations about the drought with neighbours and in the local farmers association. By combining insights based on facts on the ground in Eastern Norway with discussions of vulnerability to climate change and extreme weather events, this theoretically-informed case study seeks to contribute to theory development (George and Bennett 2005; Ragin 1994). In studies of single cases many instances can be investigated, and the interplay between evidence-based images and theoretical ideas can lead to progressive refinement of both through a process of retroduction (Ragin 1994). Theory development and refinement of key concepts seems to be increasingly relevant in a world likely to experience even more severe climate change in the decades ahead (Field et al. 2012).

'The hottest summer ever' in Norway

Climate change will have significant consequences for Norwegian agriculture. According to some climate models, the growing season in Norway could increase by one month by 2050,

and by two months towards the end of this century (Hanssen-Bauer et al. 2017). Earlier research suggested that climate change could be beneficial for Norwegian agriculture, with grain production expected to increase by more than 50 per cent compared to 1992–1993, or more if multi-cropping and irrigation are included (Fischer et al. 2001). However, this positive prognosis does not take into consideration how the quantity and quality of yields might be influenced by increased incidents of pests and diseases, by soil erosion and nutrient deficiencies resulting from climate change, and by extreme weather events (Bechmann and Deelstra 2013; O'Brien et al. 2004).

The growing season has already become longer in Norway. However, rainfall has also increased by 20 per cent at the national level. This has led to an increase in the number of incidents of heavy rainfall. Norway has experienced several summers and autumns with very wet conditions, leading to crop losses and increased costs and reduced income for farmers. There is growing concern over the long-term effects of wetter conditions, as this contributes to increased runoff, nutrient loss, and soil erosion, as well as soil compaction by heavy machinery. This has already resulted in reduced yield per hectare for many farmers (Bardalen et al. 2018).

Adapting to warmer and wetter conditions is a challenge for Norwegian farmers. There are some signs that farmers have already started to adapt to wetter conditions, for example by increasing investments in constructing ditches to remove excess water. Such measures will improve plant growth and reduce emissions of CO_2 and nitrous gases (Norwegian Environment Agency 2020). This work is, however, in an early phase and knowledge about the links between agricultural practices and emissions of CO_2, methane and other gases is still limited (Bardalen et al. 2018).

However, what happens when the problem is not too much rainfall, but too little? How does this affect the vulnerability of farmers, and of the agricultural sector more generally? A new landscape of vulnerability became evident during the summer of 2018, when temperatures records were broken in many locations in Europe north of the Alps, contributing to extreme impacts such as wildfires, drought, and heatwaves (Buraas et al. 2020). The hot and dry conditions seen in Europe north of the Alps in 2018 were experienced as record-breaking temperatures in Norway.

According to the Norwegian Meteorological Institute, the very warm May-July period in Norway in 2018 was remarkable, with temperatures on average 1.2°C warmer than the

previous record in 2002 (Gangstø Skarland et al. 2019). The period from May to July had an average temperature 3.1°C above normal and 74 per cent of normal precipitation. Nationally, it was the fourth driest May to July period since data were first recorded, starting in the year 1900 (Gangstø Skaland et al. 2019). The combination of extremely high temperatures and well below average rainfall had considerable consequences for agriculture., and little drought adaptation of ecosystems in Norway has contributed to this (Buraas et al. 2020).

According to Statistics Norway, the decline in agricultural output in 2018 lowered mainland economic growth by 0.2 per centage points (Bougroug and Ånestad 2019). Abnormally warm temperatures throughout the summer resulted in poor plant growth and forced maturation. The fact that the drought started in May contributed to this (Buraas et al. 2020). However, these physical impacts were experienced within a changing socio-economic environment. Agriculture in Norway has been undergoing structural change, and currently consists of 39,000 farmers operating an average farm size of 25 hectares. Since 1990 the number of farmers has been reduced by 60 per cent and the average farm size has increased by 150 per cent, with more farmland concentrated in the hands of fewer farmers. Only three per cent of Norway's land is suited to agricultural production, and about one per cent is suitable for growing grain for human consumption. The agricultural sector in Norway is small compared to neighbouring countries Sweden and Denmark, and grain production is limited. As an example, Danish grain production is 6–8 times larger than in Norway (Statistics Denmark 2019).

Vulnerability in Eastern Norway

What was remarkable about the summer of 2018 in Eastern Norway, according to the Norwegian Meteorological Institute, was a mean temperature from May to July that was 4.3°C above the 1961–1990 average, combined with a 40 per cent reduction in rainfall (Gangstø Skaland et al. 2019, 17). The combination of very warm and dry weather contributed to very high evapotranspiration from the fields and the plants, which resulted in a particularly severe situation of agricultural drought. To illustrate the magnitude of the temperature anomalies, Table 13.1 presents temperature and precipitation data for the 2018 growing season (May–September) in the town of Årnes, located in a major grain production area in Eastern Norway. The maximum temperature reached 34.1°C in July, and there were seven days with maximum temperatures above 30 degrees. The low precipitation at Årnes, well below the average of Eastern Norway, illustrates local variation.

Table 13.1 Weather in the growing season at Årnes 2018

Month	Temperature in °C			Precipitation in mm		
	2018	Average (1961–1990)	Difference	2018	Average (1961–1990)	Difference
May	15.3	9.8	5.5	27.8	53	−25.2 (−47.5%)
June	16.3	14.2	2.1	36.8	60	−23.2 (−38.0%)
July	20.7	15.2	5.5	17.8	62	−44.2 (−71.3%)
August	14.8	14	0.8	43.2	86	−42.8 (−49.7%)
September	11.4	9.7	1.7	84.1	76	+8.1 (10.7%)

Source: Norwegian Meteorological Institute

By early June, it was already evident to farmers that their fields were affected by the drought. The hardest-hit farmers produced yields in the range of 20 per cent of normal. At farms with less clay and more organic material in the topsoil, germination was more successful and fields were green by early June. However, the continuation of dry and warm conditions throughout the summer resulted in yields well below average for farmers in Eastern Norway. In terms of grain and grass production, yields in 2018 were reduced by 50 per cent compared to average yields (Statistics Norway 2019). Table 13.1 presents production data for two major grains; wheat and oats. The figures for wheat include both winter and spring varieties, the winter varieties were less hard hit than the spring varieties. Wheat production includes wheat for human consumption and fodder for animals (Table 13.2).

Table 13.2 Production of wheat and oats in Eastern Norway in tons

Grain	Average (2012–2016)	2018	2018 compared to 2012–2016
Wheat	3,43,000	1,27,000	#######

Oats	2,56,000	1,44,000	#######

Source: Statistics Norway

While all farmers in Eastern Norway were affected by the drought, some farmers proved more vulnerable than others. Both soil conditions and farming practices influenced outcomes at the level of individual farms. For farms with topsoil with high clay content and little organic material, the problems started immediately after planting in early May, which is a critical time for seed germination. With temperatures as much as 6.5°C above normal, together with only half the normal amount of rainfall, many seeds were simply unable to sprout. This was particularly a problem in fields that had been plowed. When fields are plowed, soils dry up quickly in spring, which facilitates early planting. Under normal conditions, i.e., with normal temperatures and rainfall, this practice results in good germination in May and fields show the potential for a good harvest. As a consequence of the weather conditions in May and June, water content in the topsoil was too low (below six per cent) to allow for germination. This had dramatic consequences for crop yields.

A 50 per cent reduction in production resulted in a 50 per cent reduction in income from grain sales. The ‘hottest summer ever’ thus demonstrated that grain producers are economically vulnerable to extreme dry springs and summers. This vulnerability raises important questions concerning responses at both the level of individual farms and the societal level.

Responding to extremes: Implications for the vulnerability landscape

Farmers and agricultural institutions in Norway responded to the warmer and drier summer of 2018 in a number of ways. Whether these responses address long-term risk and vulnerability, however, depends on whether 2018 is considered to be an extreme anomaly, or a harbinger of future conditions for farming in Norway. To structure our analysis of the range of responses discussed in newspapers and interviews, we consider how they correspond to three interacting spheres of transformation. This framework provides a heuristic for understanding relationships among the practical, political, and personal spheres of transformation that are involved in reducing vulnerability to climate extremes (O’Brien 2018). The practical sphere includes technical and behavioural responses that directly address the consequences of extreme weather. The political sphere represents changes to the systems and structures that facilitate or hinder actions in the practical sphere. The personal sphere includes the individual and shared beliefs, values, worldviews and paradigms that not only shape goals and outcomes

but also influence social and cultural norms, how systems are organised, and how institutions relate to vulnerability and climate change risks.

Vulnerability reduction in the practical sphere

Vulnerability to drought in Eastern Norway can be linked to the characteristics of individual farmers, including their economic situation, amount of debt, and total household income that comes from farming activities. Income diversification was one factor that significantly reduced vulnerability to the 2018 drought. Multiple sources of income, including income from other activities than farming, reduced the economic consequences of the drought at the farm level. Only about 12 per cent of Norwegian farmers receive more than 90 per cent of their income from farming alone. Among farmers that produce only grain, no more than 1 per cent receive more than 90 per cent of income from farming.

Among the very few farmers who maintained normal yields were those who had irrigation equipment. Such equipment is generally considered too costly for grain production. Irrigation of large areas of farmland also requires stable access to large quantities of water. During the drought, many smaller rivers almost dried up, and only the largest rivers and lakes could support irrigation. The few farmers with irrigation equipment had to work around the clock to operate the machinery throughout the summer. This resulted in high costs related to both labour and energy. Nonetheless, they were able to harvest normal amounts of grain in August.

Due to the drought in 2018 the seed supplies in front of the 2019 season were critically low. In earlier years, wet summers have caused problems for the production of seeds, as heavy rains in August and September have a negative influence of maturing of grains and reduces the overall quality and the germination of the grain when it is planted the next spring. A series of wet seasons between 2015 and 2017 resulted in a large supply of seeds of rather low quality. In contrast, ‘the hottest summer ever’ of 2018 resulted in seeds of good quality, but in very limited supply. One direct consequence was limited availability of seeds for planting in the spring of 2019. The manager of one of the major suppliers of seeds warned farmers in a written statement in January 2019:

> The 2018 season resulted in seeds with good germination, but the harvest left us with limited supplies. Sometimes during the winter season we will be sold out of seeds grown in Norway. Due to our good relations with actors in

> neighboring countries we will be able to import seeds that to some degree has been tested in Norway. This import will help us cover most of the needs the coming spring.

Varieties of seeds used in major grain-growing countries like Germany and France are not suited for Norway, since the growing season in Central Europe is both longer and warmer. It is only Finland and mid-Sweden that have a growing season similar to Eastern Norway, thus the number of seed suppliers in this region is limited. Although major actors, including government institutions, are aware of the vulnerability of seed production in northern Europe, effective measures have yet to be taken to address this vulnerability. The poor harvest of 2018 accentuated questions concerning self-sufficiency due to limited supplies of domestic grain as a basic foodstuff and access to seeds for the next planting season. Access to seeds suitable for a changing climate in the north of Europe is a fundamental question for the future of farming.

Vulnerability reduction in the political sphere

The economic losses experienced in 2018 were distributed unequally among farmers. However, both cultural and institutional factors play a key role in reducing vulnerability. To understand the changing landscape of vulnerability in Norway, it is necessary to explore how the drought was handled in the political sphere, which relates to the cultural norms, institutions, regulations, and incentives that influence or impede practical responses. In the case of Eastern Norway, resources were mobilised across networks, regions, and institutions when the extent of the drought became clear in early July.

Cultural expressions of solidarity helped to reduce vulnerability to the drought. In a study of adaptation among farming communities in Norway, Eriksen and Selboe (2012) emphasise the importance of social relations and trust. In Norway, the attitude of a ‘dugnad’ or collective effort has a long tradition, especially during times of crisis. Indeed, mechanisms of trust and collective thinking were operating among farmers during ‘the hottest summer ever.’ Dairy farmers where hard hit by lack of fodder due to very small harvests of grass. Grain farmers were asked to collect straw from the harvest and offer it to dairy farmers as emergency fodder. As told by one informant:

> Contact was established between buyers and sellers of straw. (…) All the straw from the grain fields was collected and sold or given away to livestock

> farmers. It was an amazing ‘dugnad’ by the farmers and shows the solidarity in the sector. Farmers wanted to help each other.

The exchange of limited resources outside normal market mechanisms was organised by networks of farmers and local farmer's associations. Volunteers set up a website to connect those with extra fodder with those who were in need. These efforts reduced vulnerability among dairy farmers.

The largest purchaser of grains and provider of seeds and other farm inputs in Norway is the cooperative ‘Felleskjøpet,’ owned by farmers. The cooperative mobilised its economic and organisational resources to help its owners through the drought. Due to the drought situation north of the Alps (Buraas et al. 2020), it was not possible to import fodder from nearby countries such as Denmark or Sweden. Canada offered to sell grass, but the offer was declined due to a high risk of importing unwanted species. Grass was instead bought from Iceland and distributed by Felleskjøpet. The cooperative also collaborated with the dairy farmers’ cooperative, ‘Tine’ to provide farmers with information about where and how to access fodder for animals. Norway’s culture of cooperation, organised through formal and informal institutions, thus played a significant role in reducing vulnerability during ‘the hottest summer ever.’

The institutional set-up of Norwegian agriculture also played a prominent role in supporting grain farmers in times of crisis. Most farmers are members of the Farmers Association and there are local branches in every municipality. During the summer of 2018, local branches of the Farmers Association invited farmers to talk about the crisis and to find support in sharing problems with each other. Farming can be a lonely occupation, so to provide an opportunity for the farmers to talk to and support each other, and feel connected to others was important. Although most farmers came through the crisis without suffering long-term consequences, a limited but unknown number of farmers experienced severe economic problems. One of the managers in the Farmers Association described their responses as follows in an interview:

> We [the Farmers Association] have the position that if we suspect that anyone are having a hard time, we should not be scared to invite ourselves for a cup of coffee. We are worried that those struggling are the ones we do not hear from.

Other institutions also took actions to reduce vulnerability in the agricultural sector. Banks offered economic advice to farmers and The Ministry of Agriculture removed customs on

imported fodder. A government-operated relief scheme enabled farmers to seek economic compensation for their losses. Based on applications, farmers could receive a compensation covering up to 60 per cent of average sales income from grain. About 11,000 farmers in Eastern Norway received 150 million EUR in compensation from the government during autumn and winter 2018/19, with each farmer receiving on average about 13,000 EUR. This was important, since the compensation financed purchase of input for the following year's growing season. However, the compensation was not sufficient to offset a significant reduction in farm income.

While institutions helped to reduce vulnerability, these actions have to be contextualised within longer-term structural change in Norwegian agriculture. These structural changes have contributed to increased biophysical and economic vulnerability:

> Farmers recognize that structural changes in Norwegian agriculture during recent decades have influenced, and in certain areas increased, farmers' vulnerability. In order to use large tractors and machines more efficiently, fields have been enlarged by removing lines of trees that formerly divided them and putting small streams in pipelines (Flemsæter et al. 2018, 2056).

Such structural changes have been supported by national agricultural policies since the 1960s (Almås 2002). These structural changes were part of the 'productivist' turn in agriculture across Europe in the aftermath of World War II (Spaargaren et al. 2012). Norway experienced annual productivity growth in the agricultural sector of four per cent after 1990, which is twice the productivity growth in industry (Ladstein and Skoglund 2005). Productivity growth and structural changes have provided the general population with relatively cheaper food. Specialisation in one or two productions at the farm level has been part of such ongoing change. This has resulted in economies of scale and productivity growth, but it also increased vulnerability among farmers. Specialising in grain when the harvest fails due to weather conditions is one example of reduced resilience due to specialisation at the farm level. In the context of the 2018 drought, this specialisation meant farmers had to collaborate across the different divisions of labour within the farming community to reduce vulnerability.

Vulnerability reduction in the personal sphere

Perceptions play an important role in how one calculates future risks and assesses vulnerability (Slovic 2000), and it influences the long-term actions one takes to reduce risk and vulnerability in the political and practical spheres. Perceptions concerning the likelihood of a drought happening again provide different motivations for the actions deemed important to the informants. The summer of 2018 suggests that sustained periods of hot and dry summer weather are part of ongoing climate change across larger areas of northern Europe (Buraas et al. 2020). Future climate scenarios for Norway project temperature increases of about 4.5°C by the end of this century, together with increased rain, changes in precipitation patterns, shrinking glaciers, and rising sea levels (Hanssen-Bauer et al. 2017). However, as a signatory to the Paris Agreement on climate change, Norway is obliged to work to keep the global temperature increase well below 2°C. As a result, it is important for Norway to align climate change mitigation and adaptation policies with sustainable development of agriculture and food systems. Yet while climate change is widely discussed in politics and the media, responses to climate change have so far not been pronounced in the agricultural sector in Norway:

> …even though many farmers see and reflect on the connections between climate change and agriculture, few take specific actions to adapt to or mitigate climate change. … Farmers have taken a few actions voluntarily, mostly for economic reasons, and often connected to support schemes. There were some examples of ecologically motivated actions, but these seem to be rather rare. (Flemsæter et al. 2018, 2057)

Climate change mitigation through a reduction in greenhouse gas emissions needs to be integrated into Norwegian agricultural policies. There is a significant but largely unknown potential for carbon capture and storage in the topsoil by changing farm practices (Norwegian Environment Agency 2020). Through organic farming and other practices such as no till agriculture, the content of carbon in the topsoil will increase, relative to conventional farm practices such as ploughing. Based on current knowledge, optimising the use of nitrate-based fertiliser combined with planting more wheat and Canola in the autumn seems to be among the most promising ways forward concerning reduced emissions from grain production in Norway (Bardalen et al. 2018, 56). Winter varieties of Canola did well during the 2018 drought and researchers in agronomy argue for more Canola production in Norway, which is very limited at present. Based on such advice, a voluntary agreement between government

and the Farmers Association has been reached. The Farmers Association has established a vision for a fossil-free agricultural sector within 2030.

While this sounds promising, there is no consensus among farmers about the significance of climate change. Based on participatory observation, interviews, and newspaper articles, it became evident that there are two positions on how farmers make sense of the challenges of the summer of 2018, which influence responses to the challenges. One position is based on the belief that 2018 was an exception and something that would not likely happen again, whereas the other position is that this was something farmers should be better prepared for in the future. The first position was summarised by an informant as follows:

> I believe 2018 was an extreme year, and that it will not happen again. The meteorologists explained that is was a very special weather situation with a blocking high pressure. I do not believe that the grain producers can be prepared for years that are this dry. If a year like this happens, it is important to reduce the costs by reducing fertilizers and pesticides.

This informant argued for the need to accept the losses and focus on limiting the economic damages by being critical towards which activities to prioritise. Actions such as using fertilisers and pesticides have high costs and are only prioritised when it is considered economically beneficial to do so. During the hot summer of 2018, farmers were advised to do nothing by the extension services. Irrigation was only prioritised for crops when it would be economically beneficial to do so.

The second position was formulated quite precisely by another grain farmer, who also had a managerial position within the Farmers Association:

> We need to be prepared that this can happen more frequently. We have to have a plan that is better than the one we had this year, it was a bit all over the place. We have to get coordinated earlier. The individual farmer has to build a buffer stock, for example with grass. The individual farmer has to have their own preparedness.

If actors within the agricultural sector believe that climate change poses risks to agriculture in Norway, and that adaptation and mitigation policies are related, it is more likely that political and practical actions will be taken to address the structural drivers of vulnerability, which includes addressing the sources of greenhouse gas emissions. The personal, political, and

practical spheres are interlinked and interacting, and vulnerability reduction, or lack of such reduction, involves all three of them. Only the second position identified in this study acknowledges the need to prepare for increases in future climate risks such as drought. Although the precise number of farmers and other actors who see a need to be better prepared is unknown at the moment, this number is too small to be able to set the agenda for better preparedness and thus reduced vulnerability.

Conclusion: A vulnerable future?

The consequences of the drought of 2018 were reduced largely due to the institutional setup of the agricultural sector in Norway. Farmer helping farmer according to the cultural norm of 'dugnad' and with the support of farmer-owned cooperatives were highly important to overcome both economic and psychological consequences of the hottest summer ever. A government-operated insurance scheme contributed significantly to ease the economic burden of the drought. A well-organised farming community able to cooperate with government agencies was important in this respect. However, the institutional setup was pushed to its limits and some of the limitations have been demonstrated.

In the aftermath of the drought, no systematic discussion has taken place in the farming sector concerning the root causes and drivers of vulnerability. 'The hottest summer ever' was followed by the summer of 2019 with good conditions for grain production across Eastern Norway. The months of May and June in 2019 were cool and wet, which resulted in grain yields ten per cent above average. The good yields in 2019 made it easier for farmers to forget the drought of 2018. There are no signs of plans to address extreme weather events in Norwegian agriculture. There have been talks, but they have not resulted in much more than support for developing better varieties and an advice to farmers to prepare themselves by storing fodder and seeds. The Farmers Association still supports the ongoing specialisation and structural change towards larger farms, and considerations about economies of scale triumph over concerns about increased vulnerability. Political initiatives to reduce meat consumption to mitigate CO_2 emissions and improve public health are met by resistance from large parts of the farming community. Measures to adapt to a changing climate in the practical sphere are, however, implemented when backed by government financial support. This includes support for ditches and reduction in ploughing in the autumn.

With the exception of some discussion about mitigation of climate change within the agricultural sector, no links were made to Norwegian fossil fuel policies, or to addressing the larger drivers of climate change risks and vulnerability. The drought of 2018 is rapidly becoming an event of the past and it is easy and comfortable to forget about it. We suggest that changes such as those experienced in 2018 will affect agriculture in different ways, depending on the type of production, location, and potential for adaptation. Vulnerability will be experienced differently across scales, yet will be strongly influenced by social and economic changes within the agricultural sector. The future of Norwegian agriculture lies as much in collaboration and the quality of institutions as in the weather, and perceptions of the relationship between weather and climate change will influence whether the risks of climate change continue to increase in the decades ahead.

According to the UN Food and Agriculture Organization (FAO), agriculture and food systems are an important part of the climate solution, 'But they must transform through inclusive, multisectoral approaches that reduce emissions, draw down carbon, and boost climate resilience and adaptation' (FAO 2019). So far there are few signs of such a transformation in the agricultural sector in Norway. The lack of powerful measures to avoid increases in vulnerability in Norway seems to be part of a global trend of business as usual. This makes the extreme emission scenarios for climate change even more likely:

> Under the extreme emission scenario (RCP8.5), the frequency of droughts is projected to increase over the whole of Europe, with few exceptions: moderate increase over Switzerland, Hungary, Poland, Belarus, Lithuania, and central Scandinavia, and mixed tendencies over Iceland. The severity of droughts is projected to strongly increase over the southern third of Europe and over northernmost Scandinavia. Excluding central Iceland and southern Norway, the entire European continent will be affected by more frequent and severe droughts as the century passes. (Spinoni et al. 2018, 1732)

The potential for Norwegian farmers to increase production in a future with severe pressures on farmland in key agricultural areas in Europe is very limited. At the same time, Norway is becoming increasingly dependent on importing grain to feed its population and seeds for growing grain when drought hits Eastern Norway. This case study thus challenges the assumption that vulnerability is about 'those others' (e.g., poor people in economically developing countries). This is increasingly being revealed as a myth, and it is part of a larger

vulnerability narrative that has allowed business as usual to continue for decades. The typical narrative communicated by national and international institutions working on vulnerability and disaster risk has largely approached climate change as a technical problem that requires tactics and measures to reduce the impacts of gradual or extreme events through adaptation policies and practices. Rather than transforming the underlying drivers of vulnerability, many strategies and programs have focused on adapting to climate change impacts and risks through 'development as usual' (Eriksen et al. 2015). The measures taken within Norwegian agriculture described in this chapter are basically part of a business-as-usual scenario. This case study emphasises that responses to risk in a highly developed economy have been decoupled from the wider social and political context that generates vulnerability in the first place. Environmental risks have been treated as separate and distinct from social, economic, and political processes. Such a separation of environmental risks and social processes perpetuates fragmented approaches that have deepened rather than alleviated vulnerability to climate change.

In many cases, the concept of 'vulnerability' is still reduced to a superficial diagnosis that can be addressed through techno-managerial adaptations (Nightingale et al. 2020; O'Brien and Selboe 2015). In treating vulnerability as primarily a technical challenge, the structural and systemic factors are often ignored. In other words, the social, economic, political, and cultural relationships that perpetuate inequality, uneven development, exploitation of people and resources, concentration of power and wealth among fewer people and corporations, and the continued development and consumption of fossil fuels are generally not addressed. Reducing vulnerability calls not only for understanding what makes people vulnerable, but also addressing the multiple processes that are contributing to risk and vulnerability. In the absence of transformative change, it is likely that stories of 'the most extreme summer ever,' will be told again and again.

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