

Chapter 13

Agriculture and Nutrition: The End of Hunger



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Abstract A robust supply of healthy food was the challenge in the domain of agriculture and foods in the twentieth century. Despite the agrarian successes of the nineteenth century (see Chap. 8), two world wars and the Great Depression had rendered food supply a persistent core element of government policy. Investments in agriculture like reclamations and land re-allocation transformed the landscape. Cooperation among the government, knowledge institutes and industry promoted mechanisation of agriculture. The use of artificial fertilisers and crop protection substances became widespread. Mixed farms transformed into specialized enterprises. The supply chains of agricultural products became longer and more complex.

In the food processing industry too innovations led to long international supply chains and new processing methods. New relationships between producers and consumers were the result. Consumer had to be convinced of the quality of food products by means of government quality control and informational campaigns.

The new production chains were a major contributor to the degradation of the natural landscape and the reduction of biodiversity, both domestically and internationally. This culminated in growing social unrest and by 1970 in a more critical view of developments in agriculture and the food processing industry. This was the

prelude to measures in the area of sustainable agriculture and food production (see Chap. 18).

Keywords Agriculture · Food supply · Reclamations · Land re-allocation · Rationalisation · Specialisation · Longer supply chains · Biodiversity · Food quality · Consumption patterns

13.1 Ode to Winter

'I hear the bitter winter calling
 The snow keeps falling, falling, falling
 We're singing gaily young and old
 We're getting now so nice and cold
 The cold will make us strong and hearty
 My father's job has just departed.
 Food's becoming very dear
 The rent is due all through the year.
 We're very far from being merry,
 My youngest sis has dysentery.
 That gives us one less mouth to feed,
 How good is God! How great his deeds.'

This satirical poem, *Ode to Winter*, was read to the Second Chamber of parliament in December 1903 by the SDAP (Social-Democratic Workers' Party) parliamentarian K. ter Laan in the budget debate during deliberations on primary education.¹ In the debate, Ter Laan pressed for extra finances for food and clothing for children. The verse, according to Ter Laan, had been reprinted in Belgian, French, German and Austrian newspapers to underscore the abysmal living conditions in the Netherlands. Amsterdam city councillors responded irritably and even saw sacrilege in the verse. The political squabble caused by the poem illustrated that around the turn of the century food was an important and timely issue.

Food production and nutrition would remain on the political agenda throughout the twentieth century. Part of the problem was the distribution of food. As in the poem, the poor were still living from hand to mouth, though as a rule the Netherlands had more than enough food. The situation had improved since the nineteenth century, but what additional measures were called for? Food security was a major issue. Two world wars had demonstrated that the food system was vulnerable in extreme situations. What policies had to be developed to banish hunger permanently? The distribution of food and food security belong to the classic core of well-being and sustainability and go back to the nineteenth century and earlier. In large part they determined the quality of life of the Dutch population. These problems would be largely solved in the twentieth century but in their place new sustainability issue

¹ Staten-Generaal *Handelingen Tweede Kamer* 1903–1904 15 December 1903, p. 937.

arose. The food problem shifted to issues of quality and healthy nutrition. Additionally problems with the environment and the landscape came to the fore.

We shall use three case studies to illustrate the changing character of sustainability: (1) reclamation and land consolidation, (2) crop protection and artificial fertiliser and (3) food quality: the so-called ‘disk of five’. We close this section with an overview of dynamics in the food supply chain between 1910 and 1970.

13.2 The Transformation of the Landscape

Well into the 1970s food security was the subtext of innovations and policy in the domain of agriculture and nutrition. In 1985, Th. M. Bakker of the Institute for Agricultural Economics was able to conclude in his dissertation that the problem of food security in the Netherlands had been solved. Using mathematical models he demonstrated that:

... were we in the future, for whatever reason, unexpectedly to be confronted with a lengthy disruption of the supply of food and food constituents from abroad, then we would not in the short term ... have to fear for a famine.²

Given that the means of production remained intact and provided that an annual energy input of 31.8 MJ would be available for producing artificial fertiliser, it would be possible on the basis of a diet composed of ‘cereals...and a sliver of pork’ to achieve a consumption of 2350 kcal per capita per day.³ A century after the agrarian crisis the food supply seemed secure, even in times of war when the Netherlands would have to make do without imports of agricultural products.

²T. M. Bakker, *Eten van eigen bodem: Een modelstudie* (Den Haag 1985), 14.

³Bakker, *Eten van eigen bodem*, 11. In Bakker’s dissertation different theoretical scenarios are quantitatively assessed. The question at issue is whether the territory of the Netherlands and the associated agricultural produce could supply enough food in the event of a complete moratorium on international imports. These scenarios are based on the transformation of agricultural production with the feeding of the domestic population as primary goal. In this way four scenarios are worked out in the dissertation. In the table the most important features:

Scenario	Land use	Energy equivalent 1 = 31,8 MJ	Input – output energy production	Input- output energy chain	Population size	Menu
1 – Minimum	50%	1	26:100	61:100	13.8	One-sided
2 – Maximum	100%	5.5	52:100	162:100	30.0	One-sided
3 – Responsible	76%	1.7	–	–	16.4–17.9	Responsible
4 – Habitual	100%	2.3	–	–	13.8	Unchanged

This was possible thanks to radical changes in agriculture and land-use. From the time of the agrarian crisis in the nineteenth century, there had been increasing cooperation between the government and various organizations active in agriculture. Agriculture was not to be protected by import duties but rather stimulated. Specialisation and intensification would allow Dutch agriculture to claim a new position in the free international market propagated by the government. The first sign of the new cooperative spirit was the formation in 1893, by the Minister of Agriculture, of the Netherlands Agricultural Committee (NLC), a national coalition of the provincial Agricultural Boards. The NLC emphasized the importance of improving agricultural technology. In 1898 a Department of Agriculture was set up within the Ministry of Internal Affairs, which enabled structured consultations between the government and the organised agricultural sector to take place.⁴ Agricultural research and education was further professionalised. Between 1904 and 1918 the National Agricultural School (established in 1876) acquired a fully academic status.⁵

One of the most visible agricultural developments was the expansion and modification of agricultural land by means of draining polders, reclaiming land and land consolidation. Yields were increased by introducing crop improvement, artificial fertiliser and chemical agents to protect crops.⁶ Yields per hectare of potatoes, sugar beets, grains and other crops grew steadily (Graph 13.1). Labour productivity in agriculture grew apace. Farming acquired an industrial and entrepreneurial character. The supply of food increased and dependency on food from abroad declined. We start with reclamation and land consolidation.

The Dutch landscape underwent a transformation in the twentieth century. Large regions of moorland disappeared to become farming land and forests. Agricultural plots and grasslands were in turn swallowed up by urban expansion. Researchers at the Alterra institute at the Wageningen University calculated that in the year 2000 only 7% of the moors were still located where they had been in 1900. For deciduous forests the figure was 25% and for pine forests 36%. In the twentieth century only large parcels of grassland and urban areas remained untouched (Fig. 13.1).⁷ Open natural terrain declined from more than 6000 km² to less than 2000 km² in the 1970s. The greatest decline occurred in the interbellum and immediately after the Second World War (Table 13.1).

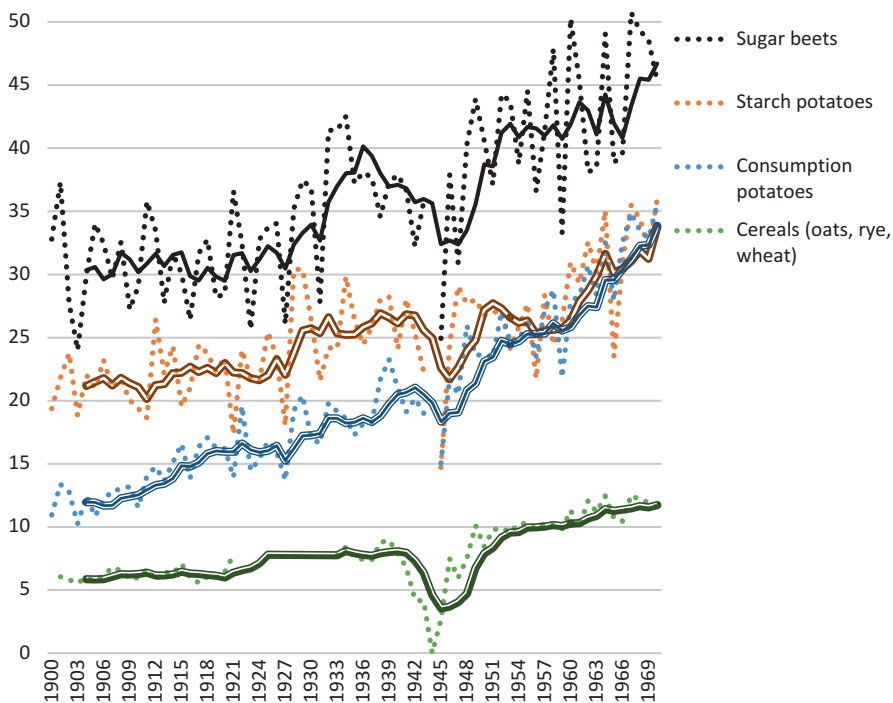
From the outset of the century, aficionados of nature and their associations kept a sharp eye on encroachments into natural terrain. After the ornithological associations founded in the final decade of the nineteenth century, 1901 saw the founding

⁴Piet de Rooy, *Ons stipje op de waereldkaart: De politieke cultuur van modern Nederland* (Amsterdam 2014), 205.

⁵J. van der Haar, *De geschiedenis van de Landbouwwuniversiteit, (Deel I) van school naar hogeschool, 1873–1945* (Wageningen 1993).

⁶Jan Bieleman, *Boeren in Nederland: Geschiedenis van de landbouw, 1500–2000* (Amsterdam 2008), 463.

⁷W.C. Knol, H. Kramer and H. Gijsbertse, *Historisch grondgebruik Nederland: Een landelijke reconstructie van het grondgebruik rond 1900* (Wageningen 2004).

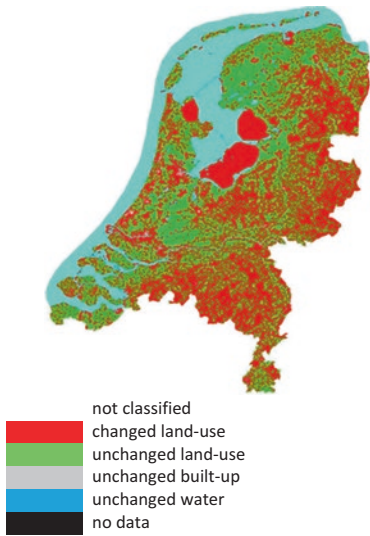


Graph 13.1 Yields of potatoes, sugar beets and cereals 1900–1970 (tons/ha)
Source: CBS – *Landbouw vanaf 1851 (Agriculture since 1851)*

of the more generic Netherlands Natural History Association and 1905 the founding of the Association for the Preservation of Natural Monuments. Initiators of these associations were representatives of the societal elite who either via networks or professional functions were closely associated with landscape development. The preservation of ‘rare’ and ‘curious pieces’ of plants and animals belonged to the core values of the movement. The associations established nature preserves and agitated for legal protection for rare species.⁸ After the economically inspired laws on hunting (1852), fisheries (1857) and useful animals (1880), the associations scored a success in the Bird Law of 1912, that protected birds living in the wild. In addition the associations exerted themselves in favour of the Forest Laws of 1917 and of a law on Scenic Beauty that was passed in 1928.⁹ These laws laid a legal foundation under their ambitions. But what was the relationship between the value

⁸H. van der Windt, ‘De totstandkoming van ‘de natuurbescherming’ in Nederland,’ *Tijdschrift voor Geschiedenis* 107(3) (1994), 485–507.; H. van der Windt, *En dan: Wat is natuur nog in dit land?, Natuurbescherming 1880–1990* (Amsterdam 1995).; J. Cramer, *De groene golf: Geschiedenis en toekomst van de Nederlandse milieubeweging* (Utrecht, 1989).

⁹M. Coesèl, J. Schaminée, and L. van Duuren, *De natuur als bondgenoot: De wereld van Heimans en Thijssen in historisch perspectief* (Zeist 2007), 208–213.



	1900	1970	2000
Forest	10.8	10.3	10.4
Moorland	13.9	1.2	1.1
Grassland	42.0	50.8	47.0
Farmland	27.9	29.3	27.4
Built up areas	1.9	6.8	12.3
Sand/dune	1.8	1.3	1.4
Miscellaneous	1.6	0.3	0.4

Table: percentual change in land-use 1900, 1970 and 2000 (excluding water).

Map: Change in land-use between 1900 and 2000

Fig. 13.1 Changes in land-use 1900–2000

Source: H. Kramer and W.C. Knol, *Historisch grondgebruik Nederland: Grondgebruik rond 1970 in 500 meter grids* (Wageningen 2003); W.C. Knol, H. Kramer, and H. Gijsbertse, *Historisch grondgebruik Nederland, Een Landelijke Reconstructie van het grondgebruik rond 1900* (Wageningen 2004). The table shows the percentual figures of land-use. In the studies just cited data is provided in km². However there is an enormous discrepancy in measured surface area between 1970 and 2000. In the measured surface areas for 1900, 1970 and 2000 the largest discrepancies are to be found in the category ‘water,’ which is why it is left out of the table

Table 13.1 Land-use in the Netherlands in km²

	Agrarian		Forest		Open natural terrain	
		+/- in %		+/- in %		+/- in %
1900	21,160		2520		6240	
1905	21,270	0.5	2570	1.9	5840	-6.8
1910	21,540	1.3	2600	1.2	5530	-5.6
1915	22,010	2.1	2570	-1.2	5110	-8.2
1920	22,180	0.8	2480	-3.6	4930	-3.7
1925	22,530	1.6	2490	0.4	4480	-10.0
1930	22,950	1.8	2540	2.0	3910	-14.6
1935	23,350	1.7	2550	0.4	3570	-9.5
1940	23,240	-0.5	2580	1.2	3580	0.3
1945	21,680	-7.2	2410	-7.1	3270	-9.5
1950	25,050	13.5	2420	0.4	2730	-19.8
1955	25,330	1.1	2450	1.2	2370	-15.2
1960	25,520	0.7	2680	8.6	2360	-0.4
1965	25,690	0.7	2890	7.3	1900	-24.2
1970	25,520	-0.7	2980	3.0	1990	4.5
1975	25,160	-1.4	3080	3.2	1690	-17.8

Source: CBS – Bodemgebruik per provincie vanaf 1900

of nature and the utility of reclamation and land consolidation? How were the different values weighed in practice?

13.2.1 Reclamations

At the end of the nineteenth century, reclaiming the moors was above all a matter of planting new forest. The use of artificial fertiliser also made it possible to transform the heath meadows into grazing pasture or crop fields. Reclamation was carried out by private firms - except for state-owned lands for which an agency called State Forest Management (*Staatsbosbeheer*) was called into being in 1899. Two firms played a pivotal role: the Heidemij (the *Nederlandse Heidemaatschappij* founded in 1888) and the Grondmij (the *Grondverbeterings- en Ontginningsmaatschappij* founded in 1915). They advised on the transformation into forest, crop fields or pasture; proposed improvements in drainage and water-level management; and executed the plans.

Pressure increased on available agricultural acreage during the First World War. The government emphatically encouraged reclamations (and new polders) in order to increase food production. After 1920 reclamations became far less profitable. Profitability was partly dependent on the ability to export agricultural produce. The weakened purchasing power of German consumers as a result of the hyperinflation of the early 1920s as well as increasing competition from Danish, Australian and New Zealand products in the British market caused falling prices.¹⁰ The situation only worsened during the economic crisis.

In cooperation with the agricultural organizations, the government exerted itself to the utmost to protect agriculture and the many small family farms. This so-called 'green front' in which the government and the agricultural organizations cooperated closely, aimed to guarantee a domestic and foreign market for agricultural produce. Agricultural policy continued to pursue the expansion of agrarian acreage. This seemed counterintuitive given overproduction and the low prices of farm produce. But the increase of acreage aimed both to decrease dependency on foreign agricultural produce, especially cereals, as well as to strengthen the position of small farmers and at the same time provide work for the legions of the unemployed.¹¹ In the first half of the twentieth century on the sand grounds in the east and south of the Netherlands, farms increased their acreage by more than 33% thanks to reclamation (Table 13.2).¹²

¹⁰Bieleman, *Boeren in Nederland*, 209.

¹¹De Rooy, *Ons stipje op de wereldkaart*, 210.; P.H.M. Thissen, 'Van Heide tot boerenland en bos, Regionale verscheidenheid in heideontginningslandschappen, 1850-1940,' in M. de Harde and H. van Triest, *Jonge landschappen, 1800-1940* (Utrecht 1994), 21-37.

¹²Bieleman, *Boeren in Nederland*, 408.

Table 13.2 Reclamation of 'wastelands', 1875–1975

Year	Area of Wastelands in ha
1875	766,000
1890	713,000
1900	591,000
1910	543,000
1920	482,000
1930	378,000
1940	270,000
1945	260,000
1955	205,000
1965	235,000
1975	225,000

Source: N.H. Lier, *Een Bont Patroon, Vijfendertig Jaar Cultuurtechniek* (Wageningen 1981), 14

Initially, nature lovers were enthusiastic about reforestation, but this began to wane as the pace of heath reclamation for agriculture increased.¹³ Though the State Forest Management (*Staatsbosbeheer*) and the municipalities tended to spare parcels that were scenically attractive, this was not enough for the Society for the Preservation of Natural Monuments. The society bought scattered parcels of heath in the provinces of Brabant, Overijssel and Drenthe, as well as in the Veluwe region in order to preserve regional variety. In 1929 the society set up the Heath Fund, based on public donations. Its first purchase was the Dwingelerveld in Drenthe, a 37 km² region of slightly accidented heathland dotted with fens and bogs. These purchases were controversial, as the 1924 acquisition of the De Campina region near Boxtel in Brabant demonstrated; in order to prevent local disturbances, this purchase was conducted in secret.¹⁴

In 1932, Nature Monuments, the ANWB (cyclists' and motorists' association) and other nature preservation associations, set up the Contact Commission for Nature and Landscape Protection, with the aim of representing the interests of nature and the agrarian landscape to the government. These associations agitated against the structural changes in agriculture, like reclamation and land consolidation.¹⁵ These preservationists, however, had a difficult time propagating the interests of nature preservation, certainly when toward the end of the 1930s the persisting economic crisis claimed increasing attention for the problem of unemployment.

'There is a danger that our generation, in order to temporarily mitigate some of the suffering of unemployment, will forever ruin much of beauty in our country to the detriment of all that come after us.'

¹³Van der Windt, *En dan: Wat is natuur nog in dit land?*, 103.

¹⁴Thissen, *Van heide tot boerenland en bos*, 30–31.

¹⁵J. Dekker, *Dynamiek in de Nederlandse natuurbescherming* (Utrecht 2002), 26–28.

as the engineer J. Loeff, from the Gooi region near Utrecht, put it in 1939.¹⁶ His remark was incited by the plans for poldering and reclamation proposed by the government inspector for work projects, engineer J. Th. Westhoff in a report to the minister of social affairs, C.P.M. Romme. The report occasioned a heated debate between representatives of agriculture and preservationists about the use and function of natural regions. It got much publicity in the national and regional papers and journals, including professional journals.

Preservationists saw Westhoff's plans as a serious threat with dire consequences for nature. What would remain after reclamation would be 'little parks.'¹⁷ The prominent socialist politician Henri Polak climbed the barricades against the destruction of what he called 'treasures of beauty.'¹⁸ Frisian preservationists associated with It Fryske Gea emphasized the consequences of the disappearance of nature for the local economy. On the other hand, the Royal Netherlands Agricultural Committee was a staunch advocate of drastic expansion of agricultural acreage. Under the banner of 'The Netherlands, dare to live,' chairman H.D. Louwens articulated his criticism in local and regional newspapers:

... Natural beauty can be enjoyed only with a clear conscience. When natural beauty has to be maintained at the cost of the pleasure in labour of the unemployed and of lost life-chances for young farmers then it can no longer be experienced in innocent joy, because then it is burdened by a dark cloud of human suffering. True joy, including the joy of free nature, can never be egotistical.¹⁹

Nature was a luxury product, subservient to economy and welfare.

13.2.2 Land Consolidation

After the Second World War the transformation of the landscape acquired an extra dimension due to land consolidation projects. The government's agricultural policy took a new turn. From efforts to maintain employment for the many small farmers and farm labourers, policy turned to mechanisation, rationalisation and upscaling of farm work. Sicco Mansholt, minister of Agriculture between 1945 and 1958, shaped this so-called 'structure policy' that was supported by new laws and by intensive cooperation between agricultural organisations and government agencies. The Agriculture Foundation, founded in 1945 by the three farmers' organisations and farm workers' unions, consulted monthly with the Minister of Agriculture and Food Supply. With the founding of the Agricultural Board (*Landbouwschap*) in 1954 this

¹⁶ 'Utrechtse en Hollandse plassen bedreigd' in *Utrechts volksblad : sociaal-democratisch dagblad*, 02-05-1939.

¹⁷ 'Natura' in *Het Vaderland: Staat- en letterkundig nieuwsblad*, 12-10-1939.

¹⁸ 'N.V.V. en Plan-Westhoff' in *Het volksdagblad: dagblad voor Nederland*, 6-2-1939.

¹⁹ H.D. Louwes 'Nederland durf te leven' in onder andere *Nieuwsblad van het Noorden* (3-1-1939) *Leeuwarder nieuwsblad* (3-1-1939) *De Graafschap Bode* (4-1-1939) , *Nieuwsblad van Friesland* (4-1-1939), *Leeuwarder courant* (4-1-1939), *Zaans volksblad* (4-1-1939) *Utrechts volksblad* (4-1-1939) en *De Tijd* (4-1-1939).

corporatist consultation assumed the form of a ‘national agrarian parliament.’²⁰ Government policy aimed at the continued strengthening of the international competitive position of Dutch agriculture. A stable market for agricultural produce was created thanks to guaranteed national and later European selling prices.

Agricultural organisations like farmers’ co-ops devoted themselves to improvements in the supply chain. They invested in the supply and shipment of raw materials and products, via their own channels like slaughterhouses, dairies, egg hatcheries and vegetable auctions. In the post-war years most farms shifted from mixed to specialized production. Farms became links in longer food supply chains. The meat-poultry supply chain, for example, became lengthened with ‘multipliers’ who supplied ‘breeders’ with fertilized eggs, who supplied ‘fatteners’ with chicks, who delivered chickens to the slaughterhouses.²¹

Government policy aimed at structural improvements in productivity per farm. Policies were supported by new ideas and approaches taken from United States Marshall Plan technical support programs, research at Wageningen Agricultural University, and national agricultural schools. Education and advice via Government Agricultural Consultants directly and indirectly stimulated the mechanisation and rationalisation of Dutch farms.²² One of the more ambitious and controversial aspects of the plans was a policy aimed at scale increases.²³ With larger parcels of land, agricultural efficiency could be further increased.

This made land consolidation one of the core aims of the structural policy. Due to purchases and divisions in the past, farmland was often fragmented into small parcels divided by fences, paths, hedgerows, wood banks, ditches, brooks etc. The aim of land consolidation was to unite the fragmented pieces into larger wholes and to optimize access, soil quality, drainage and water supply in the service of efficient production. Land consolidation implied a physical intervention, in addition to an economic and legal trajectory of land exchange and value-compensation. In land consolidation areas, the land was levelled, ditches moved, hedgerows and wood banks cut down and accessibility improved with new roads.

The first modest - and voluntary - land consolidation projects date from the nineteenth century. After the turn of the century the Royal Netherlands Agricultural Committee embraced the idea. After the First World War the national government began to formulate a policy for land consolidation, building among others on land consolidation laws in which procedures and financial arrangements, including gov-

²⁰De Rooy, *Ons stipje op de wereldkaart*, 211–22.

²¹H. Veldman, E. van Royen and F. Veraart, *Een machtige schakel in de Nederlandse land- en tuinbouw: De geschiedenis van Cebecco-Handelsraad, 1899–1999* (Rotterdam 1999), 177–192.

²²J. Grin, J. Rotmans, and J. W. Schot, *Transitions to sustainable development: New directions in the study of long term transformative change* (New York 2009), 287–88.

²³Especially groups of small farmers feared the plans for upscaling. Mansholt denied that upscaling was a goal in itself, but he kept insisting on upscaling via land consolidation. In any case, later policy measures and the centralisation of marketing would later on lead to agricultural upscaling. See: Grin, Rotmans, and Schot, *Transitions to sustainable development*, 285–290.

ernment funding, were laid down.²⁴ The unification of various commissions concerned with reclamation, drainage and land consolidation, led in 1938 to the founding of the Central Commission for Cultivation Technology (CCC). The Heidemij (a reclamation firm) played an important role in consultation and execution.²⁵

The various agricultural and governmental agencies also consulted with nature conservation organisations, represented by the Contact Commission for Nature and Landscape Protection. In 1948 exchanges among the different parties led to the founding of the Consultation Commission for Nature and Landscape Protection the aim of which was to manage local conflicts around reclamations. The consultation platform, that in the end met only 13 times, had a difficult time finding a niche in the rapidly changing and ever more tightly organised agrarian world. After the creation of the Agricultural Board in 1954, the consultations came to a halt for the time being.²⁶

By then, the structural transformation of agriculture had shifted into a higher gear. In 1954 a new land consolidation law came into effect.²⁷ The procedures were further simplified by equalizing the legal status of land renters and owners. In the voting on the consolidation plans, abstention was now to count as a vote *for* a new landscape plan. A special organisation, the Cultivation Technology Service, developed the plans in the name of the CCC and looked after the financing of the projects. Execution of the plans fell to the reclamation firms Heidemij, Grontmij and other engineering bureaus.²⁸ These measures aimed to speed up the process of land consolidation in order to meet the challenge of declining global prices for agricultural produce.²⁹

The approach bore fruit. The large number of applications required a certain prioritization. That resulted in 1958 in a Multi-annual Plan for Land Consolidation. Plans were brought together in so-called ‘regional improvement projects’. These

²⁴S. van den Bergh, *Verdeeld land: De geschiedenis van de ruilverkaveling in Nederland vanuit een lokaal perspectief, 1890–1985* (Groningen 2004), 42–45. The first law dated from 1924. A new land consolidation act in 1938 increased the options for those wishing to take initiatives and granted new subsidies. This law proved inadequate for larger land consolidation projects. Temporary legislation filled the breach, as in the Land Consolidation Law Walcheren of 1947, initiated by the inundations during the war, and the Law on Land Consolidation of Emergency Zones after the 1953 flood disaster.

²⁵In 1935 the State Commission for Drainage, the Advisory Commission for Reclamation of Wastelands and the Central Commission for Land Consolidation were consolidated into the Central Advisory Commission for Cultivation Technology (*Centrale Cultuurtechnische Adviescommissie*). In 1938 this was renamed the Central Commission for Cultivation Technology. Van den Bergh, *Verdeeld Land*, 45.

²⁶Dekker, *Dynamiek in de Nederlandse natuurbescherming*, 84–85; J. Dekker, ‘De dynamische opstelling van het landbouwschap ten aanzien van het milieu, 1948–1972,’ in *Jaarboek voor Ecologische Geschiedenis*, (Eekhout 2008).

²⁷H. Buiter and J. Korsten, *Land in aanleg: De dienst Landelijk Gebied en de inrichting van het platteland* (Zutphen 2006), 19–47.

²⁸Buiter and Korsten, *Land in aanleg*, 60–61.

²⁹Van den Bergh, *Verdeeld land*, 46–51.

projects included more than just land consolidation. Extension services and schooling in the areas of technical knowledge and entrepreneurship were set up to support the modernisation of farming. A Development and Renewal Fund was called into being in 1963 to help small farmers who wanted to stop. In this way policy makers wanted not only to 'improve' the physical structure, but the social structure as well.³⁰

The agencies, firms and governments involved in land consolidation were primarily interested in promoting agriculture and the economy. Initially, there was broad political and social support. In the 1960s, landscape consolidation projects had increasingly to be coordinated with urban and infrastructural developments. This created more room for recreational areas and other urban claims on the landscape. On paper the interests of nature and landscape were incorporated into the new land consolidation legislation that came into force in 1954. Around 1950 nature preservation comprised 1% of the budget. This grew to 6% around 1970.³¹

There were incidental controversies. In 1964, for example, farmers levelled a number of wood banks in a land consolidation region in Twente before the plans had been approved. This unilateral action caused considerable consternation within nature conservation organizations and led to questions in parliament. Despite the commotion, the farmers were not sanctioned. Within the Cultivation Technical Service, initiatives were taken behind closed doors to discuss and align the different social interests. In this context, H.P. Gorter, director of the Society for Natural Monuments, was appointed to the Central Committee for Cultivation Technology in 1968 as representative of the nature conservation organizations.

Social unrest around land consolidation projects increased toward the end of the 1960s. The vote for a new land consolidation plan in the town of Tubbergen in the Twente region, for example, elicited violent protest. The protest was aimed particularly at the voting procedure. In the first vote the plans had been adopted with 27 votes in favour and 12 against. The votes of the 2938 entitled voters who didn't show up counted as being in favour of the plans. This, in accordance to the rules that were in effect – rules once adopted to simplify land consolidation. This outcome was followed by riots in which the mayor's house was set on fire and the police were called out. Opposition in Tubbergen was broad-based. Unrest was caused particularly by the undemocratic nature of the land consolidation procedures. Besides providing an occasion to revise the procedures, the unrest also created a window of opportunity for bringing non-agrarian interests to centre stage. This inspired the restructuring of government agencies around a broader vision of land planning, incorporating the interests of agriculture, nature and landscape planning.³²

The challenge for the period after 1970 was a more thorough integration of nature values and recreation into land planning. By 1985 this resulted in a land-planning law that put an end to land consolidation informed exclusively by an agrarian perspective. But into the 1980s, the agricultural lobby continued to wield

³⁰Van den Bergh, *Verdeeld land*, 52; Bieleman, *Boeren in Nederland*, 467–473.

³¹J.L. van Zanden and S.W. Verstegen, *Groene geschiedenis van Nederland* (Houten 1993), 83.

³²Buiter and Korsten, *Land in aanleg*, 77–79.

Table 13.3 Changes in surface area of different landscape types with variegated ecotopes

	1920	1950	1976	1988
Sandbanks/mudflats	24,000	26,000	12,800	12,000
Marsh (excl. forest)	36,000	26,500		21,000
Sand drifts	12,700	11,000	4300	1800
Living high moors	33,000			160
Excavated and drained high moors	23,400			9800
Heathland	377,000	108,000	79,000	35,800
Forest	248,000	242,000	309,000	328,700

Source: R.J. Bink et al., *Toestand van de Natuur 2* (Wageningen 1994), 93

significant influence. Between 1924 and 1985, in 452 projects, 1,490,520 hectares of land was newly parcelled. Land consolidation projects were pending for another 448,630 hectares. Over the course of 60 years, about two million hectares of agricultural acreage had been reorganized or were about to be so.³³ That amounted to some 59% of the surface area of the Netherlands.

The interventions in the landscape due to reclamations and land consolidation contributed to the decline of diversity in flora and fauna. Landscape types like marshes, mud flats and living peat moors as well as landscape elements like wood banks disappeared (Table 13.3). Specific ecotopes became smaller and more widely separated. Changes in water management, in part carried out to make it easier to work with agricultural machines, led to desiccation in many places.

The changes caused some species to disappear, while others flourished. Research into the historical development of biodiversity has demonstrated that, especially in the second half of the twentieth century, humans negatively influenced Dutch biodiversity.³⁴ Reclamations and land consolidation made the landscape more monotonous. Among animals, it was especially the reptiles, amphibians and butterflies that were victimized by the changes in the landscape. Ecotopes disappeared, became smaller and more fragmented.³⁵ The decline was strongest in the riverine zones, sand grounds and the hilly country.³⁶ Possibly not by chance the regions that were most affected by the physical interventions (see Fig. 13.1).

³³J. Bieleman, Landbouw, in *Techniek in Nederland in de twintigste eeuw* (Zutphen 1993), 63.; Bieleman, *Boeren in Nederland*, 468.

³⁴J. Noordijk et al., De Nederlandse biodiversiteit, *Nederlandse Fauna*, 10, 339.

³⁵Noordijk et al., *De Nederlandse biodiversiteit*, 339–354.

³⁶J.A. Weinreich and C.J.M. Musters, *Toestand van de natuur: Veranderingen in de Nederlandse natuur* (Den Haag 1989), 225.

13.3 The Modern Farm and the Environment

The transformation of the landscape was only one of the aspects of the agrarian transition. Another aspect was the modernisation and rationalisation of the farm itself. The government took a leading role in this process. It programmed research, put much effort into extension services and supported education. The knowledge infrastructure that emerged would later become known as the OVO-triangle (for the Dutch words *Onderzoek* – Research –, *Voorlichting* – Extension –, and *Onderwijs*, – Education). It occupied itself among other things with mechanisation, artificial fertiliser and crop protection. The Netherlands developed the highest agricultural productivity in the world and also used the most artificial fertiliser and crop protection substances (insecticides and herbicides) per hectare. These radical innovations contributed substantially to the solution of the food problem, but at the cost of initiating new ecological calamities. What were the motive forces behind these developments? How did the Dutch deal with the new sustainability challenges?

13.3.1 Artificial Fertiliser

Artificial fertiliser together with an increase in the number of cattle sounded the death knell of the pre-modern cycle of fertiliser production. The increase of livestock in the last decades of the nineteenth century put an end to the fertiliser shortage. It broke open the conventional fertiliser cycle. Heath meadows became largely superfluous for the making of fertiliser.³⁷ The collection of human faeces in cities also became irrelevant, a development that was also applauded and encouraged in hygienist circles. The fertiliser cycle between the city and the countryside came to an end. The collection of faeces in barrels was replaced by hygienic sewer systems.³⁸

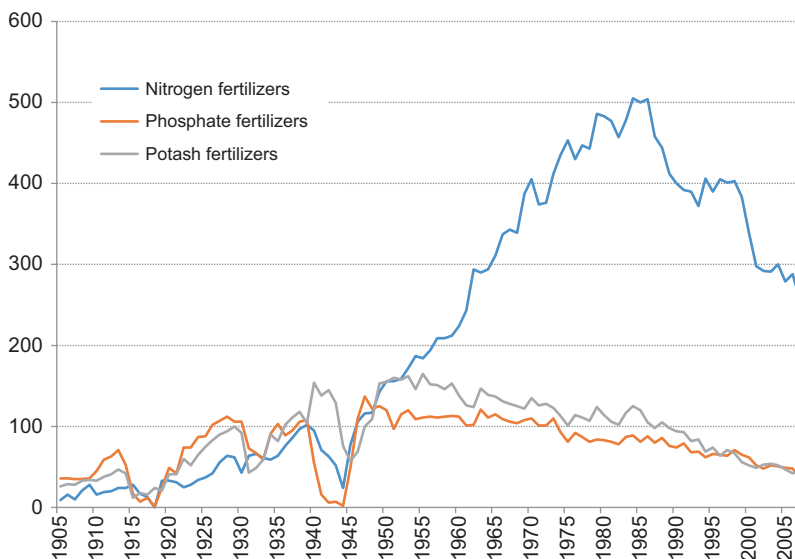
The use of artificial fertiliser shows a steady growth since the beginning of the twentieth century, with the exception of the two war periods (Graph 13.2). The zenith was reached in the 1980s. More than 700 kilotons of artificial fertiliser were used in agriculture in this period, equivalent to about 350 kg per hectare.³⁹ Before the Second World War, the growth was associated with a number of factors.

The knowledge infrastructure as it developed from the end of the nineteenth century stimulated the use of artificial fertiliser. Government agricultural advisors shared experiences in the area of fertilization at the state agricultural experimental stations (*Rijkslandbouwproefstations*) with individual farmers and farmers' study

³⁷M.T. Knibbe (2000), 'Feed, fertilisers, and agricultural productivity in the Netherlands, 1880–1930,' *Agricultural History* 74(1): 39–57.

³⁸This was reinforced by public health and hygienic initiatives. H. van Zon, *Een zeer onfrisse geschiedenis. Studies over niet-industriële vervuiling in Nederland, 1850–1920* (Groningen 1986), 147–157.

³⁹E. Homburg, *Groeien door kunstmest, DSM Agro, 1909–2004* (Hilversum 2004), 94.



Graph 13.2 Use of artificial fertiliser in the Netherlands 1905–2007, in kilotons

Source: CBS t/m 1998: Tweehonderd jaar statistiek in tijdreeksen, from 1999: Land- en tuinbouw-cijfers 2008 (LEI)

groups. Analysis of and knowledge about fertilisers was concentrated in 1915 at the experimental stations in Maastricht and Groningen. On the basis of this specialization the stations were in a better position to develop procedures and guidelines for the application of artificial fertiliser and to combat fraud. In addition, traders and importers, keen to market the new product, set up their own advisory bureaus for artificial fertiliser.⁴⁰

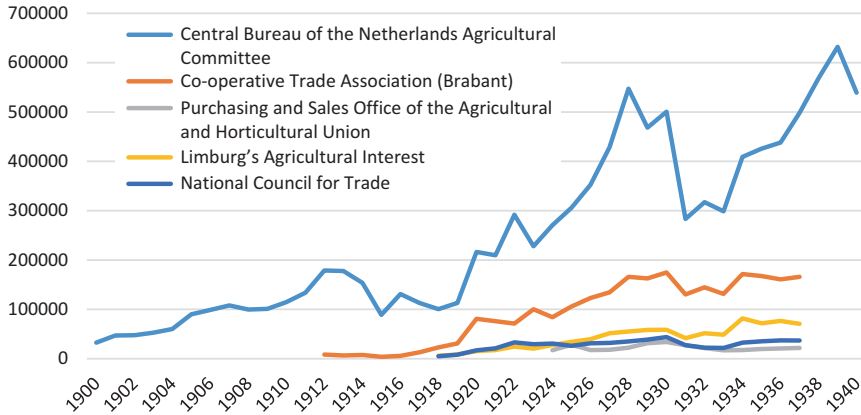
Farmers' cooperatives also played an important role. By means of collective purchasing they were able to break the power of the German trade cartels. In this manner the Central Bureau of the Netherlands Agricultural Committee (CB), founded in 1899, developed into the biggest importer of artificial fertilisers (Graph 13.3).⁴¹ Membership of such purchasing associations was popular. In 1920 more than half the farmers were members of a cooperative.⁴²

Production and trade in artificial fertiliser were important factors in the increased use of artificial fertiliser and acquired an ever-more national character. On the eve of the First World War, artificial fertiliser was produced in the Netherlands in six superphosphate factories and a number of smaller factories producing the nitrogen-based fertiliser ammonium sulphate, mostly prepared from a waste product of cokes

⁴⁰Homburg, *Groeien door kunstmest*, 29–30.

⁴¹Veldman, Van Royen and Veraart, *Een machtige schakel in de Nederlandse land- en tuinbouw*, 22–56..

⁴²Bieleman, *Boeren in Nederland* 287.



Graph 13.3 Trade in artificial fertilisers by Cooperative Associations 1900–1940

Source: H. Veldman, E. van Royen en F. Veraart. *Een machtige schakel in de Nederlandse land- en tuinbouw, de geschiedenis van Cebeco-Handelsraad, 1899–1999* (Rotterdam, 1999), 54

production.⁴³ The First World War interrupted the supply especially because raw materials like ammonia and saltpeter were also important ingredients in the production of explosives. Inadequate supplies forced the Dutch superphosphate factories into mergers. During the war, the government compelled merchants, co-operatives and importers to work together in acquisition associations. In the course of the war and immediately thereafter they pursued a more independent course with respect to foreign suppliers and raw materials. In December 1919, following the example of various municipal gas factories, the State Mines started producing ammonium sulphate at the cokes factory of the Emma mine. This was followed in 1923 by the production of this fertiliser at the cokes factories of the Hoogovens iron and steel plant in IJmuiden.

The invention of the Haber-Bosch process to synthesize ammonia, patented in 1910 and first implemented in 1913 by the German chemical giant BASF, was an important technical innovation. The First World War facilitated its rapid diffusion.⁴⁴ In 1929, using this process to synthesize ammonia, the Company for the Exploitation of Cokes Oven Gas (MEKOG) – a joint venture of Hoogovens and Shell – started the production of artificial fertiliser. This was followed in 1930 by the State Mines

⁴³The merger bore the name United Chemical Factories (*Vereenigde Chemische Fabrieken (VCF)*). The Amsterdam Superphosphate Factory (ASF) also belonged to this combination but continued its activities under its own name. In 1948 the combination changed its name to Albatros.

⁴⁴The Haber-Bosch process was developed by two Germans: the academic Fritz Haber and the engineer Carl Bosch. Their process produced ammonia by combining hydrogen from methane gas with nitrogen from the air. In 1913 the Badische Anilin und Soda Fabrik (BASF) set up the first large-scale ammonia production facility based on this process. Between 1916 and 1923, via obscure routes, French, Italian, German and Swiss chemists succeeded in developing alternatives to the Haber-Bosch process. These alternatives were marketed on the basis of licenses. See Homburg, *Groeien door kunstmest* 17.

Table 13.4 Share of different nitrogen fertilisers in Dutch agriculture, fertilizing years 1923/1924–1928/1929

	1922/1923	1924/1925	1926/1927	1928/1929
Chile Saltpeter	83.3	57.6	32.6	32.1
Ammonium Sulphate	14.7	39.9	57.5	41.7
Calcium Nitrate	1.6	1.4	5.9	17.3
Calcium Cyanamide	0.4	1.1	1.0	3.1
Other	–	–	3.0	5.8

Source: E. Homburg, *Groeien door kunstmest*, DSM Agro 1929–2004 (Hilversum, 2004), 43, table 2.2

with its Nitrogen Binding Company (SBB). That same year in the town of Sluiskil, another artificial fertiliser factory under the name of Compagnie Néerlandaise de l'Azote (CNA) opened its doors. Its production of 45,000 tons of artificial fertiliser per annum made it for a brief time the largest factory of its kind in Europe.⁴⁵ Between 1921 and 1927 no fewer than 28 factories for the production of synthetic ammonia and 31 nitrogen binding factories sprung up all over Europe.

Price drops in the 1920s as a result of overproduction in the Dutch and European artificial fertiliser industry was the final factor in the increasing the use of this commodity. Prices dropped dramatically. Other fertilisers like those derived from urban wastes and faeces disappeared from the market.⁴⁶ At the same time, prices for agricultural produce were also depressed. Farmers responded by increasing production and using more fertilisers.

Well into the 1920s, Dutch agriculture still used mostly imported fertilisers like Chile saltpeter. But this import was gradually abandoned and Dutch industry began to dominate artificial fertiliser production (Table 13.4). The sector looked for solutions to the price drops. The State Mines secured a significant national market in 1930 by signing contracts with the agricultural co-operatives Central Bureau (CB) the Co-operative Trade Association (CHV) and the Limburg's Agricultural Interest (LB). After 1927, the European nitrogen industry formed a cartel with agreements about limiting production and dividing the market. In 1930, the *Convention de l'Industrie de l'Azote* (CAI) allowed the State Mines and MEKOG as part of the so-called 'Holland group' to divide the domestic market between themselves. CNA at Sluiskil would produce exclusively for the foreign market. The Central Nitrogen Sales Office (CSV), set up in 1934, centralized the sale of nitrogen-based fertilisers within the Netherlands. In time the cartel succeeded in stabilising prices. But during

⁴⁵Homburg, *Groeien door kunstmest*, 94.; E. Homburg, 'Van carbo- naar petrochemie, 1910–1940', in J.W.Schot et al. (ed.) *Techniek in Nederland in de twintigste eeuw, deel II: Delfstoffen, Energie en Chemie* (Zutphen 2000) 332–357.

⁴⁶The Company for Ammonia Manufacture from Faecal Matter (1890–1902) and the First Netherlands Factory for Chemical Products (1902–1915) produced ammonia salts and ammonium sulphate from the then extant Liernur system of sewerage. Homburg, *Groeien door kunstmest*, 39; Van Zon, *Een zeer onfrisse geschiedenis*, 147.

Table 13.5 Use of nitrogenous artificial fertilisers in selected European countries, 1913–1951 (in kg/hectare)

	1913	1925	1926	1927	1928	1938/39	1950/51
Netherlands	7.1	16.5	20.5	21.6	26.3	37.2	71.0
Belgium	16.0	19.7	18.7	19.8	19.3	–	–
Germany	7.2	10.0	11.2	13.6	13.9	23.7	26.3
France	0.2	3.1	3.0	3.4	4.0	9.4	16.5
England	2.3	2.0	1.8	2.1	4.0	4.8	17.4

Source: E. Homburg, *Groeien door kunstmest, DSM Agro 1929–2004* (Hilversum, 2004), 44, table 2.3; ‘Hogere opbrengsten van tuinbouw en veeteelt door doelmatige stikstofbemesting’ in *Nieuws van Staatsmijnen*, 15, July 1955, 3

the 10 year period between 1922 and 1932 the price of ammonium sulfate declined from 18 guilders to about 5 guilders per 100 kilograms.⁴⁷

Firms were glad to contribute to the accumulation of knowledge. Using their own test fields, they studied the effects of fertilisation and communicated this to a broader public via advertisements, consultancy and exhibitions. The Nitrogen Binding Division of the State Mines tested their own fertilisers in various test fields of the Government Agricultural Advisors. This clarified the superiority of the new fertiliser developed by the State Mines – Chalk-ammonium saltpeter (KAS) over sulphuric acid ammonia. These results were touted in the advertisements of the Agricultural Bureau of the State Mines – set up specifically with this aim in mind. After 1935 cooperation within the Dutch nitrogen industry intensified. The Agricultural Bureau acquired an ever-more general character and in 1948 became part of the Central Nitrogen Sales Office (CSV).⁴⁸

During the interbellum, Dutch use of artificial nitrogenous fertilisers surpassed that of the surrounding countries (Table 13.5). Dutch use grew from 70 kg per hectare in 1950 to 100 kg around 1960 and almost 200 kg per hectare in the early 1970s (see Table 13.6). Dairy farming in particular exhibited the strongest post-war growth in use of nitrogenous artificial fertilisers. Of the 430,000 tons deposited on the land in 1975, more than 300,000 tons were used to fertilize grazing pastures.

Increased use of artificial fertiliser was realised thanks to the emergence of close cooperation among firms, research institutes and farmers generously supported by the government. These exertions increased both the productivity per hectare as well as the productivity of agrarian labour. The effects were amplified by plant breeding aimed at developing varieties adapted to the rapid absorption of nutrients.⁴⁹

This spectacular development was celebrated as a victory in the struggle to solve the food question. In the late 1960s artificial fertiliser surpassed animal fertilisers in the category of nitrogenous fertilisers (see Table 13.6). In the early 1970s experts at the State Consultancy for Soil and Fertilisation Issues at Wageningen and the Institute for Soil Fertility at Haren first expressed concern about possible

⁴⁷ Homburg, *Groeien door kunstmest*.

⁴⁸ Homburg, *Groeien door kunstmest*, 85–90.

⁴⁹ Bieleman, *Boeren in Nederland*, 285.

Table 13.6 Animal manure production and fertilizer use, 1935–1995

	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995
Application of artificial fertiliser in kg/ha farmland														
Nitrogen (N)	19	28	41	36	70	80	96	137	177	210	241	251	206	208
Phosphate (P ₂ O ₅)	47	45	24	23	54	48	48	51	49	44	42	44	38	32
Potassium Oxide (K ₂ O)	41	36	66	26	69	72	59	61	56	54	62	62	49	35
Manure production cows, pigs, poultry in kg/ha farmland														
Nitrogen (N)	.	.	.	.	91	.	110	122	163	196	240	280 ^a	287	292
Phosphate (P ₂ O ₅)	.	.	.	.	49	.	58	64	78	92	114	126 ^a	110	107
Potassium Oxide (K ₂ O)	.	.	.	.	102	.	122	133	183	221	265	310 ^a	305	322

^aData 1984

Source: CBS – Historische Reeksen Landbouw 1899–1999

over-fertilisation using conventional and artificial fertilisers. The priorities for environmental policy in 1972 first mentioned problems with fertiliser surpluses. The solution proposed by the KVP (Catholic Peoples Party) minister of Public Health and Environmental Hygiene was to advocate the planting of crops, like green maize, that supported a high fertilisation intensity. The relevant agricultural experts saw the increased interest in these crops as a ‘...positive development to prevent possible soil pollution by fertilisers.’⁵⁰ The solution was a textbook example of a corporatist arrangement involving the political establishment and agricultural organizations. Ranks were closed in the ‘green front’ and on the sand grounds the cornfields shot out of the ground like mushrooms. For the time being fertilisation hardly encountered resistance. That was certainly not the case with the use of crop protection substances.

13.3.2 Crop Protection

The use of chemical crop protection substances incited the first post-war criticism of the agricultural modernisation process. The spectacular development of chemical crop protection substances much resembled the introduction of artificial fertilisers. Here too, public-private cooperation within the network of agricultural organisations, government and private industry played a key role.

The first experiments with the chemical control of mould infections, especially in the fruit and flower bulb sectors, date from the 1930s. After the Second World War the introduction of dichloro-diphenyl-trichloroethane (DDT) initiated a revolution in the use of chemical insecticides. Successes during the war with combatting typhus (lice) and malaria (mosquitos) stimulated further research. The substances generated much enthusiasm. Broad international appreciation was expressed in the Nobel prize accorded to the Swiss chemist Paul Müller for developing DDT.

As lovers of the potato plant, exotic insects like the Colorado beetle constitute a threat to ‘our daily meal.

as the cinema newsreel Polygoon put it in 1947.⁵¹ Chemical insecticides like DDT were a formidable weapon against this enemy. In 1950, following up on the success of DDT, Shell developed a number of chlorinated hydrocarbon compounds like Aldrin, Dieldrin, Eldrin and Telodrin as alternative and even more poisonous insecticides. In the 1950s there was much optimism about the use of insecticides (and also fungicides and herbicides) and the possibilities offered by these chemical applications.⁵²

⁵⁰ F. Bloemendaal, *Het mestmoeras* (Den Haag 1995), 12–13.

⁵¹ In 1947 and 1948 the cinema newsreel Polygoon Journal featured items on the fight against the Colorado Beetle. See website Beeld en Geluid, Open Beelden: www.openbeelden.nl/media/670176/Strijd_tegen_de_coloradokever

⁵² J. Bieleman, ‘Gewasbescherming, dieren en gewassen in een veranderende landbouw’, in J.W. Schot, H.W. Lintsen, A. Rip and A.A. Albert de la Bruhèze (eds.), *Techniek in Nederland in de twintigste eeuw, deel 3: Landbouw, voeding* (Zutphen 2000), 210.

The modernisation of agriculture in the 1950s and 1960s was in the first place inspired by the drive for greater production and by the development of a professional and efficiency-based approach. Chemical crop protection substances helped to save labour. Mixed farms made way for specialized enterprises. In the market-garden and crop-farming sectors the number of different crops declined. This period also saw the emergence of agricultural contractors that assisted farmers with the use of specialized machinery. Plant breeding technologies aimed at suppressing leaf growth in order to promote richer ears. While this combination of developments delivered higher yields, it also caused new problems. Fewer leaves allowed more light to reach the soil and weeds proliferated. With monocultures diseases and plagues had a better chance of spreading. Shared use of (specialized) machinery increased the chance of infestation. International trade became subject to so-called 'phyto-sanitary' regulation, which specified that export product had to be a 100% free of diseases, moulds and insects. All these developments together promoted the increased use of plant protection substances.⁵³

From the very beginning, the use of chemical insecticides, herbicides and fungicides had had its detractors. As early as 1949 the director of the Wageningen Plant Disease Service had warned about excessive use of chemical plant protection substances. One of the first visible problems was that pesticides also targeted useful insects like bees or the natural enemies of pests. A second effect, especially evident in the struggle against moulds, was the development of rapid tolerance to the chemical substances, thanks to mutations in the organism. These effects stimulated a search for other means of pest, plant and mould control, varying from plant breeding for resistance, substances that were absorbed by the plant and specific plant protection substances per crop and per disease.⁵⁴

Beyond this reorientation to the use of chemical insecticides, herbicides and fungicides within the agrarian cluster, there was also increasing criticism from outside. In her 1962 book *Silent Spring*, the American author Rachel Carson described the effects of chemical insecticides, especially DDT, on the entire ecosystem. The Dutch translation, *Dode Lente*, followed a year later. It provided the foundation for a critique of modern agriculture and food supply chains from a broader environmental perspective. Spokespersons were biologists, ecologists, nature preservationists and critics of industrialisation, i.e. parties outside the powerful public-private agrarian network.

Massive bird mortality in Drenthe (1966) and Zeeland (1968) inspired a chorus of criticism of crop protection substances. The livers of the dead birds contained high concentrations of the pesticide Dieldrin.⁵⁵ From 1969 on, legal measures were

⁵³Bieleman, *Gewasbescherming, dieren en gewassen in een veranderende landbouw*, 222–223.

⁵⁴Bieleman, *Gewasbescherming, dieren en gewassen in een veranderende landbouw*, 213–221.

⁵⁵J.W. Copius Peereboom, *Chemie, mens en milieu: Schadelijke stoffen in milieu en voeding, een studie over chemische milieuverontreiniging* (Assen 1976.), 126–127. Birds of prey like the hawk and sparrow-hawk recovered after limits were imposed on the use of crop protection substances. In J. van Zoest, ed., *Biodiversiteit*, (Utrecht 1998), 133.

taken against pest control substances containing mercury. This was followed in 1972 by a ban on DDT. Despite this, the Netherlands remained the global front-runner in the use of pest control substances well into the 1980s. The road taken, in which land and labour productivity were the guiding principles in agricultural innovation, proved hard to leave.⁵⁶

The professor of animal systematics and geography, K.H. Voous of the Free University in Amsterdam had described developments in 1970 in terms of the ‘sorcerer’s apprentice, who could initiate a process, but who could not manage the side-effects of the much desired increase in agricultural yields. Humanity has poisoned nature. Can it *itself* remain healthy?’⁵⁷

After the physical deterioration of nature caused by transformations of the landscape, a qualitative deterioration set in as modernisation and the use of fertilisers and chemicals caused desiccation, over-fertilisation and environmental pollution. In addition to the direct effects of pest control substances noted above, fertilisers also caused changes in vegetation. The spread of bush grass in the dunes, common rush in peat marshes and purple moor-grass in the heathlands were the consequences. The appearance of these species changed local ecosystems of mushrooms, insects, reptiles and birds.⁵⁸ The loss of biodiversity in the Netherlands since 1950 was caused for about 30% by landscape transformations and for 60% by acidification and lowering of groundwater levels as part of the modernisation of agriculture.⁵⁹

Nature and the environment appeared for the time-being to have footed the bill for solving the problem of food security. New challenges for sustainable development emerged from the agricultural transitions that delivered food and well-being. Pesticides inspired the first measures to make agricultural developments more sustainable, to inoculate them with a concern for the integral quality of life, including concern for ecological aspects and natural resources. This was the social agenda that came to fruition after 1970.

13.4 Foods and Nutritional Patterns

Since the end of the nineteenth century, concern about food shortages has been accompanied by concern about food quality. The supply chain of production, distribution, and preparation of food changed dramatically in the twentieth century. The distance between locations of production and of consumption increased. The transformation of the food supply chains impinged in different ways on aspects of sustainability, not only in the Netherlands but also elsewhere. Thinking in terms of a

⁵⁶ Bieleman, ‘Gewasbescherming, dieren en gewassen in een veranderende landbouw, 222.

⁵⁷ K.H. Voous, *Natuur, milieu en mens* (Kampen 1970), 47.

⁵⁸ Noordijk, *De Nederlandse biodiversiteit*, 339–354.

⁵⁹ M.P. van Veen et al., Halting biodiversity loss in the Netherlands: Evaluation of progress, *Netherlands Environmental Assessment Agency* (2010), 7.

food supply chain became ever more current in the course of the twentieth century. Three facets claim our attention.

The hygienic concerns of the nineteenth century were extended into the food supply chain. Food quality and hygiene came to play a central role in the activities of the food processing industry, users' organisations and government. New patterns emerged in the food trade, in distribution and in processing in the kitchen. Monitoring was instituted to protect honest trade and educational campaigns were launched to inform consumers about food preparation and healthy nutrition.

In the second place, the industrialisation of the food processing sector led to lengthening and diversification in production chains. This shifted the effects of changing nutritional patterns to locations across the border. International trade in foodstuffs and industrial processing into foods were responsible for new foods in Dutch households and influenced economic and ecological systems elsewhere. This was associated with a chemical-analytical perspective on agricultural and fisheries products as raw materials for foods. Foods were now defined in terms of a basic or bulk product (in the trade jargon: a commodity) and in terms of proteins, fats, and vitamins. The interchangeability of raw materials transformed the food supply chains into a network of material flows. The flows of raw materials were reconstituted in factories into new compound foods, varying from margarine to soups and instant dinners.

A third facet was an increasing concern about healthy nutrition. This commenced with research into the one-sided nutritional patterns of the poor. After the Second World War a new problem arose. The formerly sober menu had been replaced by one laden with a surfeit of foods. Availability was no longer a problem, but rather the right choice from what was on offer. In the context of the different and distinct interests of private companies, consumers and governments, new informational strategies emerged in combination with efforts to combat the new welfare diseases that emerged in the wake of new nutritional patterns.

13.4.1 Food Quality: Commodities Law, Trademarks and the Modern Housewife

At the turn of the century, concern about food quality emerged within two distinct social settings. In 1905 a handbook for research into food quality, the *Codex Alimentarius*, was published and quickly became the bible for the professional-scientific approach of the internationally oriented hygienist movement. In addition, in the agrarian sector cooperation among science, private industry and government had produced a system of agricultural schools and experimental stations. Improvements in methods of chemical analysis that increased and objectified insights into the composition of foods, had made both developments possible.⁶⁰

⁶⁰A.H. van Otterloo (2000), 'Voeding,' in J.W. Schot et al. (eds.), *Techniek in Nederland in de twintigste eeuw, deel 3: Landbouw, voeding*, 254–256.

National regulation of food quality bogged down around the turn of the century in disputes about measurement methods, standards and finances among tradesmen, producers, scientists and civil servants. However, local arrangements emerged in Rotterdam (1893), Leiden (1901), Dordrecht (1909) and Drenthe (1916). The national government did develop quality standards for, for example, meat (1902) and butter (1904) mainly with an eye to international trade. During the First World War the necessity for a generic arrangement became more evident. The number of surrogates, fakes and products treated with dyes and unacceptable preservatives increased. In view of these developments, in 1919 a nationwide Food and Drugs Act came into effect based on the *Codex Alimentarius*.⁶¹

The Food and Drugs Act counted among its supporters the bona fide tradesmen and producers. They regarded the new law as a means to protect their own trade against fraudulent operators. In addition they began to employ trademarks and advertisements in order to draw attention to their industrially processed foods and their qualities. Thanks to packaging they were also able to present their products in a handy and hygienic fashion.

From the 1920s on, stiff competition became endemic in the distribution channels for food. Industrial producers like the margarine producer Jurgens acquired shares in the grocery chains of De Gruyter and Albert Heijn. Albert Heijn in turn invested in their own factories for cakes and candies. In addition various purchasing cooperatives emerged, like Enkabé (1929), De Spar (1932) and the wholesaler's group Schuitema (1934).⁶²

These developments in the production and distribution of foods coincided with ideas on the modernisation and rationalisation of the household, with the Dutch Association of Housewives (NVvH) as most important spokesperson. The NVvH had been founded in 1912 as a union of mostly middle-class housewives. By way of courses and educational materials on nutrition, cooking and hygiene, the NVvH tried to tackle the 'servant question.' Servants were becoming ever more scarce and expensive and the association wanted to make 'housewives more conscious of the task they were obliged to fulfil.'⁶³ The hygienically packaged foods and the first composite food products like stock cubes, baking powders and pudding powders merged seamlessly with the ambitions of the NVvH and the modernisation of the household.

Companies focused their attention on the modern housewife. Brands like Maggi, Calvé, Honig, Van Nelle and Verkade became trusted names in Dutch kitchens. The bond between producers and modern households were forged by means of trading stamps, coupons, sales and competitions:

The old-fashioned housewife had recourse to her own home-made store of fat: beef fat, lard or a mixture of the two, provided by the annual slaughter in November. **For the modern housewife**, who is no longer wont to keep such stocks in the cellar or the cupboard, it

⁶¹Van Otterloo, 'Voeding', 258–261; H. W. Lintsen (ed.), *Tachtig Jaar TNO*, (Delft 2012), 108–109.

⁶²Van Otterloo, 'Voeding', 264.

⁶³A. H. van Otterloo, *Eten en eetlust in Nederland, 1840–1990* (Amsterdam 1990), 157.

is of importance that she can have access to fat that is just as nutritious, just as tasty and just as economical, that can repeatedly be used in small quantities and in a fresh condition. **This fat she finds in Delfrite** (bold text in the original citation)⁶⁴

The brand names of the food processing industry became the shining examples of food quality, hygiene and the modern household.

After the Second World War the modernisation of the household got a new impulse from changes in the trade and distribution of domestic articles. During the war and as an extension of Dutch agriculture and fisheries a deepfreeze industry had developed with the German armies as an important customer. After the war, agrarian organisations agitated for a civilian expansion of this deepfreeze supply chain. Deepfreeze companies succeeded in wheedling the necessary scarce funds from Sicco Mansholt, Minister of Agriculture, in order to invest in deep-freezers. These companies and food producers like Unilever developed new forms of food conservation, processing and preparation. Vegetables, fish, meat and complete meals were offered as new deepfreeze product. The foodstuff supply chain branched and made detours that ran via industry to the cooling and deepfreeze facilities in stores and cold storage facilities. In 1956 only 3% of the Dutch households had a refrigerator, but by the early 1960s the low temperature supply chain had been completed with the massive purchase of refrigerators and freezers by households. In 1962 almost 20% of the households had a refrigerator and by 1972, 88%.⁶⁵

In 1948 the first self-service store opened its doors, to be followed in the early 1950s by large grocery chains like De Gruyter and Albert Heijn. Regulations regarding the concentration of shops that dated from the 1930s and that were intended to protect grocers, butchers and greengrocers and their specific skills initially limited the spread of self-service stores. But after a recommendation by the Social-Economic Council pointing to the rich variety of packaged products, the regulations were modified in the early 1960s. This made room for new kinds of stores like self-service stores and supermarkets with a more elaborate assortment and lower prices.⁶⁶ In the kitchens the foods were prepared in entirely new ways.

13.4.2 *International Food Supply Chains*

The international trade in foods long remained limited to products that could be easily conserved, including grain, butter, cheese and pigs. At the end of the nineteenth century technical innovations like refrigeration made it possible to transport perishable foods over ever greater distances. British industrialists developed ‘cold chains’ that guaranteed the supply of meat products. With the aid of refrigerator ships, Great

⁶⁴ Collection brochures Johannes van Dam, cited in A. H van Otterloo, *Eten en eetlust in Nederland, 1840–1990*, 166. Bold in original text.

⁶⁵ B. Sluijter, *Kijken is grijpen, zelfbedieningswinkels, technische dynamiek en boodschappen doen in Nederland na 1945* (Eindhoven 2007), 148–64.

⁶⁶ Sluijter, *Kijken Is Grijpen*, 133–40; Van Otterloo, ‘Voeding’, 284–95.

Britain imported meat from remote regions like New Zealand, Australia and Argentina. In this last country around 1900 British industrialists had invested in about 16,000 km of railways that connected the harbour of Buenos Aires with its hinterland. In the name of welfare the Argentinian army launched violent campaigns to ‘clean out’ the native population of the pampas. Australian Aboriginals too were driven from fertile lands to the benefit of international trade.⁶⁷ The removal of the ‘savages’ was doubtless legitimated to everyone’s satisfaction at the time, but it nonetheless shows the brutal and radical way in which the expansion of, in this case the British, food supply chain was effected.

Where Great Britain was often the endpoint of the supply chain, the position of the Netherlands was different. It was more like a node of supply chains. It exported pork, eggs, milk and margarine – much of it to Great Britain and Germany – and imported raw materials like cattle fodder and vegetable oils.⁶⁸

The network shaped by Dutch margarine producers illustrates the influence of such supply chains outside the Netherlands. In 1870, in the town of Oss, two families by the name of Jurgens and Van den Bergh had set up margarine factories to produce artificial butter using animal fats, a by-product of the local slaughterhouses. Both entrepreneurs profited from the growing demand from England. In 1911, as the price of animal fats rose, both firms succeeded in obtaining a license on a German process whereby liquid vegetable oils and animal fats could be hardened by means of hydrogenation. The process opened new markets for raw materials. Competitors in this search for the cheapest raw materials were the soap manufacturers.

One of the new possibilities was the use of whale-oil. Anton Jurgens and the British soap manufacturer Lever Brothers toyed with the idea of establishing their own whaling fleet. This proved a bridge too far. Instead, in 1913 a whale pool was set up, a cooperative venture among Dutch, British and Austrian soap and margarine manufacturers to purchase whale-oil in common from the Norwegian whalers.⁶⁹ These kinds of cooperative efforts formed the foundation for the later merger between the Dutch-German-Austrian *Margarine Unie* (1927) and the British Lever Brothers to form Unilever in 1929. One of the reasons for the merger was control over raw materials. As buyer, Unilever dominated trade in whale oil. This put the company in a position to pressure the Norwegian government for favourable selling conditions for margarine and soap.⁷⁰

The big demand for oils and fats by the soap and margarine industries was largely responsible for the resurgence of modern whaling. British and Norwegian fleets

⁶⁷ P. Högselius, A. Kaijser, and E. van der Vleuten, *Europe’s Infrastructure Transition: Economy, War, Nature* (New York 2016), 120–121.

⁶⁸ A. A. Albert de la Bruheze and A. H. van Otterloo, The Milky Way: Infrastructures and the Shaping of Milk Chains, *History and Technology* 20(3) (2004): 249–70.

⁶⁹ F.J.M van de Ven, *Anton Jurgens Hzn, 1867–1945, Europees ondernemer, bouwer van een wereldconcern* (Zwolle 2006), 137–140.

⁷⁰ P. Thonstad and E. Storli, Big business and small states: Unilever and Norway in the interwar years, *Economic History Review* 66(1) (2013): 109–31.

dominated the whaling industry. They developed factory ships and new harpooning techniques. These made it possible to hunt for a wide variety of whales in Antarctic waters.⁷¹ But what had initially appeared to be an endless supply of whales soon began to diminish. By the 1930s, negotiations on international agreements were underway. However, the International Whaling Commission (IWC) mandated with a coordinating role, had great difficulty maintaining headway in the face of the diverse geopolitical interests. Governments regularly leaned heavily on the IWC or unilaterally terminated agreements. Given continuing demand it appeared impossible to prevent decimation of the whale population.⁷² By the 1970s populations of most species of whale had been reduced to a mere 10% of their 1946 numbers. Whaling became one of the first symbols of the emerging nature and environmental movement as embodied in organisations like the World Wide Fund for Nature (WWF) and Greenpeace.⁷³

In addition to whaling, Unilever and its predecessors invested in plantations and oil factories in Africa, South America and the Dutch East Indies. The investments aimed to guarantee the supply of raw materials and to decrease dependency on middlemen. These concerns also moved them to invest in their own fleets. After the 1929 merger, Unilever consolidated the joint African possessions of tens of thousands of hectares of plantations, oil factories and trading posts under the flag of the United Africa Company (UAC), a trading firm at a discreet distance from the parent firm Unilever. The UAC functioned as a trading post for Unilever products and as supplier of raw materials. It exploited plantations for vegetable oil and fruit and ran its own merchant fleet.⁷⁴ The company also invested outside of Africa in the Solomon Islands, Malaysia, and the Dutch East Indies. Two thirds of the plantations cultivated palm oil, raw material for the margarine and soap industries.⁷⁵ After difficult years during the depression and the war, the UAC developed into an important component of the Unilever empire. As priority buyer from the UAC, Unilever had a dominant position in the international trade in vegetable oils and fats. After the Second World War, 10% of the multinational's profits came from the African trade.⁷⁶ The plantations also proved important to the firm for the supply of raw materials in the long term.⁷⁷

⁷¹ Factory ships made it possible to undertake longer campaigns to the richer fishing grounds around Antarctica. New harpoon techniques also made it possible to hunt whales that sunk after being killed. J. R. Bruijn en J. C.A. Schokkenbroek, *De laatste traan: Walvisvangst met de Willem Barentsz, 1946–1964* (Zutphen 2012), 14–19.

⁷² Bruijn en Schokkenbroek, *De laatste traan*, 251–56.

⁷³ A. Kalland, Management by totemization: Whale symbolism in the anti-whaling campaign,' *Arctic* 46(2) (1993): 124–33. D. Toke, Epistemic Communications and Environmental Groups, *Politics* 19, no. 2 (1999): 97–102.

⁷⁴ D.K. Fieldhouse, *Merchant capital and economic decolonization: The United Africa Company, 1929–1987*. (Oxford 1995), 176–225.

⁷⁵ Fieldhouse, *Merchant capital and economic decolonization*, 450.; G. Jones, *Renewing Unilever: Transformation and tradition* (New York 2005), 197–203.

⁷⁶ W.J. Reader, *Vijftig jaar Unilever, 1930–1980* (London 1980), 82.

⁷⁷ Jones, *Renewing Unilever*, 197–201.

The cultivation of market crops like palm oil, coffee, tea and cacao had various consequences for well-being and sustainability. Worries were expressed about erosion, droughts and the fluctuation of water levels. But forests were mainly seen as serving industries and trade.⁷⁸ At the time, the loss of biodiversity was not an issue. Jungle was replaced by plantations with a monoculture. Differentiated agricultural systems were traded in for one-sided plantations. In Southeast Asia the survival of the Orangutan was threatened by palm oil production. We also see a transformation of local economies in Asia and Africa. Unilever bought out the self-sufficient farmers, who subsequently had to survive as labourers. Where local food production no longer provided adequate nutrition, recourse was taken to more expensive import of food. In the period of decolonisation after the Second World War the economic structures also remained virtually intact and market crops contributed to the increasing inequality between the West on the one hand and Africa and Asia on the other.

The example of the growth of the Dutch margarine industry shows how flows of raw materials and sustainability issues were transported beyond the national borders. The production of food was dissociated from the places where raw materials were produced. ‘Blue Band’ and ‘Zeeuws Meisje’ – popular Dutch margarine brands – were made of whale oil and palm oil. International trade networks in raw materials made it possible for Dutch consumers to pay ‘not a penny too much’ for their margarine. The costs with respect to economic and ecological sustainability were paid in Africa and Asia. The growth of Dutch margarine production was made possible by exploiting natural capital elsewhere; in Antarctic waters and in the tropical plantations.

13.4.3 *Healthy Nutrition and Excess*

Around 1890 food costs still made up about half the household budget. In Amsterdam in 1935 this had declined to 22%. The poorest segment of the population spent 35–37% of the family budget on food and the wealthiest less than 10%.⁷⁹ In the first half of the twentieth century, diets became more varied, but the menu of the underclass continued to consist mostly of bread, milk, porridge and potatoes, once in while supplemented by a bit of meat.

Around the turn of the century socially concerned physicians began to investigate the diets of workers. They concluded that these exhibited little variety and suffered from a dearth of calories and nutrients.⁸⁰ Food shortages during the First World War and the consequences for public health led to the founding of the Netherlands

⁷⁸D.A. Zoethout, *De plant in nijverheid en handel*, (Amsterdam 1914), 84–87.

⁷⁹For 1850 data see van Otterloo, ‘Voeding’, 282; data 1935 in ‘Inkomsten, Uitgaven, Verbruik En Physiologische Waarde van Voeding, uit Verschillende Kringen Der Bevolking Gedurende de Periode 1 Maart 1934–28 Februari 1935,’ Statistische Mededeelingen (Amsterdam: Bureau van Statistiek der gemeente Amsterdam, 1935), 45.

⁸⁰Van Otterloo, ‘Voeding’, 241.

Institute for Popular Nutrition in 1919. The instigator, the physician dr. E.C. van Leersum, enjoyed the support of food processing companies and local government, including the city of Amsterdam. The Institute began to investigate the relationship between nutrition and health. In 1922 it was integrated into the University of Amsterdam.

The economic crisis and the mounting threat of war in the 1930s moved the government to take action. It was involved in the founding of the Commission for Household and Family Education (1934) that disseminated nutritional information via exhibitions, classes and demonstrations. It also supported the Foundation for Household Education in the Countryside (1935) that provided information about cooking, hygiene and health in cooperation with the Dutch Association of Housewives (NVvH) and cooking teachers. The TNO research institute - for the most part funded by the state - was augmented in May 1940, as German armies invaded the country, with the addition of a Central Institute for Nutritional Research (CVO). At the same time a Nutritional Board was founded as a sub-commission of the Health Board.⁸¹

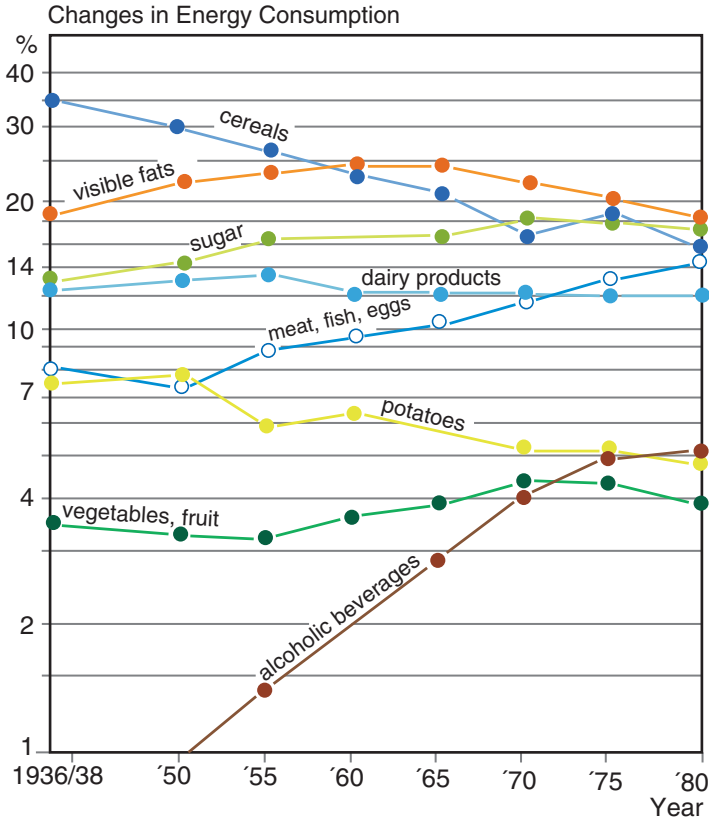
The focus of food research shifted from quantity to quality. In the interbellum, for example, a basis was laid for knowledge about vitamins. New insights revealed that vitamins were not only medicines against specific diseases, but also essential for a balanced nutrition. Via the Nutritional Board and TNO these insights rapidly penetrated into private industry and the societal 'midfield.' In 1927, for example, the food industry succeeded in fabricating a tasteless vitamin concentrate from cod liver oil that could be added to margarine. The importance of vitamins was exploited in advertisements to prize products containing such supplements. Knowledge of food quality was transmitted via informational and educational activities like cooking lessons, cookbooks and magazines.

Supplements also entailed risks. In 1960 some 100,000 people in the Netherlands suffered from an allergic reaction. After an investigation lasting several weeks it transpired that the 'blister disease' was caused by the emulsifier ME18, that had been added as an anti-spatter substance to the margarine brand *Planta*. The additive had been approved by the State Institute for Public Health after animal tests. The so-called *Planta affair* was widely publicized in the press. After Unilever had paid damages, but without admitting guilt, the affair was publicly framed as a mistake by a big and complex company. The affair did have an effect on food research: it put the safety aspects of industrially processed foods on the agenda. TNO pumped more resources into research in this field. Unilever became one of the most important clients. Next to specific research contracts it also funded half of the collective research done by the TNO Food Organization.⁸²

After the Second World War, increasing well-being manifested itself in the menu of the Dutch household. The consumption of meat, sugars, edible fats, and luxury products like nuts, peanuts and chocolate articles increased, while grain and potatoes

⁸¹ Van Otterloo, 'Voeding', 266–268.; H. W. Lintsen (eds.), *Tachtig jaar TNO* (Delft 2013), 109.

⁸² Lintsen, *Tachtig Jaar TNO*, 121–122; Van Otterloo, 'Voeding', 288.



Graph 13.4 Percentual contribution of groups of foods to the average energy consumption of the human body in the Netherlands in the period 1936–1980
 Source: J.F. de Wijn and W.A. van Staveren, *De Voeding van Elke Dag* (Utrecht 1986), 166

constituted an ever smaller part of daily energy input (Graph 13.4).⁸³ The new nutritional habits were encouraged in magazines. On their trips abroad, Dutch travellers encountered other food cultures. And countrymen returning from the Dutch East Indies and foreign guest-workers brought new dishes with them to the Netherlands. How could the country cope with this superabundance? In 1953 the Extension Service for Nutrition, modelled on an American example, introduced the so-called ‘disk of five,’ a slogan that rhymes mnemonically in Dutch: *schijf van vijf*. The disk described the basic nutritional groups that ought to compose a healthy daily diet: grain products, vegetables and fruit, dairy products, meat and fish and finally fats. This nutritional advice emphasized variety and quality. The consumption of vitamins, minerals and animal protein was to be encouraged.⁸⁴

The food industry was only too willing to contribute to an ever more varied menu. Under the banner of the modernisation of cooking it introduced pre-prepared,

⁸³ J.F. de Wijn and W.A. van Staveren, *De voeding van elke dag* (Utrecht 1986), 166.

⁸⁴ Wijn and Staveren, *De voeding van elke dag*; Lintsen, *Tachtig jaar TNO*, 117.

deep frozen and composite foods. In addition they attempted to change eating patterns by introducing new ‘eating moments.’ Such innovations often proved more difficult than imagined, but gradually new ‘eating moments’ for snacks, in-betweens, and appetizers penetrated into the daily lives of most Netherlanders. New foods like French fries, croquettes and sorbet became common. Old foodstuffs acquired new identities like ‘cheese in the fist’ (lump of cheese without bread) and ‘Hollandse Nieuwe’ (literally ‘Holland’s New,’ referring to salted herring caught in the current season).⁸⁵ Food became part of a lifestyle. Its primary function, the preservation of the human body, retreated ever further into the background.

13.5 New Food Chains, New Problems

For a long time the food supply chain had a rather simple structure. For a large number of products it ran from the farmer via the market to the plate. Often producer and consumer were one and the same: the farmer who ate his own produce and the city dweller with his own vegetable patch. In part, producers marketed their own products, like butter and cheese. For another part, products came from afar, like cereals and coffee. The food industry was limited to simple processing: grinding grain, baking bread, extracting oil etc.

Starting at the end of the nineteenth century, the food supply chain got more and more complex. First, it was evident that the chain was getting longer, that is to say, characterized by an increase in the number of links between producer and consumer and in the geographic distance between links. Second, chains were becoming more differentiated. Links split up into a variety of processing activities. Finally, the food chains began to assume the character of networks. They were coupled to organisations that did not belong to the primary production and consumption process.

In the changing food chains new dynamics emerged around the problem of food supply. This aspect of well-being had long remained limited to food distribution and food security. This remained relevant in the twentieth century, in particular due to the two world wars in which the Netherlands was confronted with hunger and scarcity. In addition, food quality moved higher up the societal agenda. Problems of excess and changing nutritional habits came to the fore. New also was the problematic issue of sustainability, in particular the landscape and biodiversity. Who addressed these problems?

At the start of the supply chain a dense network evolved that was composed of farmers, agricultural organizations, suppliers (among other things of machinery and artificial fertiliser), traders, banks (especially the Farmers’ Lending Banks), research institutes and the government. The government took a leading role, partly inspired by the war situations, the Great Depression of the 1930s and the reconstruction after the Second World War. It invested in a flourishing agricultural sector that contributed to economic growth and international trade. This ambition had to dovetail with

⁸⁵Van Otterloo, ed., ‘Voeding,’ 283; H. W. Lintsen, *Made in Holland, Een techniekgeschiedenis van Nederland 1800–2000* (Zutphen 2005), 49–50; Lintsen, *Tachtig jaar TNO*, 115.

the ambition to secure a dependable food supply for the Dutch population. The Second World War was a watershed for this policy. Until 1940 the numerous small farmers had been the focus of attention and reclamations and new polders had to contribute to conserving jobs and food security. After 1945 the government and the agricultural network devoted all their attention to upscaling, land consolidation and the rationalisation of large farms in the context of an emergent European Union. Opposition to this policy was limited and had little effect. Conservation organisations had a marginal position in the network. Other agricultural variants like the biological-dynamic approach survived only in the societal periphery.

Another network, separate from the agricultural network, emerged in the middle of the food supply chain. It was based on the increasing interchangeability of raw materials for foodstuffs, the separation of raw materials into valuable elements, the reconstitution of materials in new products, the improvement of transport and growing international flows of commerce. The position of firms like Unilever changed from being a link in the chain to being a node in an international network. In this way, the production of food in the Netherlands became intimately linked to new sustainability issues abroad. Governments and international organisations negotiated some practices like whaling, but with limited success. Other issues like the social and ecological effects of large-scale plantations were utterly ignored. That happened only in the course of the 1970s.

Finally, new networks developed in the middle and at the end of the food supply chain. They consisted of food processing firms (with a dominant position for Unilever) grocery stores and purchasing organisations (with a growing role for self-service chains like Albert Heijn), government agencies (like the Nutrition Council), research institutes (for example, the TNO Nutrition Organization) and consumer organisations (originally the Dutch Association of Housewives, later also the Consumers Union). Government bodies, research institutes and consumer organisations were the spokespersons for the issue of food quality. The food industry and food retailers jumped on this bandwagon. Around 1900 the emphasis shifted from the caloric content of foods to hygiene and perishability. In the 1930s interest increased in healthy foodstuffs like vitamins. With increasing prosperity after the Second World War organisations slowly but surely began to express concerns about the new feeding habits. The recommended diet in the 1950s - two bread meals and a main meal according to the 'disc of five' - was threatened by an enormous range of foodstuffs that could be consumed at any moment of the day.

After 1970 the latent agricultural problems would lead to widespread protests. They presaged the demise of the agricultural network that had come to full flower in this period.

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