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A STRATEGY FOR A MORE SUSTAINABLE AGRICULTURAL SECTOR

Including the CAP as an effective instrument for sustainable development

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A STRATEGY FOR A MORE SUSTAINABLE AGRICULTURAL SECTOR, INCLUDING THE CAP AS AN EFFECTIVE INSTRUMENT FOR SUSTAINABLE DEVELOPMENT

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Preface

This study was conducted as part of my study; MSc Environmental Biology at Utrecht University. As a farmer's daughter with a fascination for our natural environment, I have always been interested in the relation between agroecosystems and our natural ecosystems. This study has offered me a chance to gain knowledge, experience and skills in the field of sustainable agriculture. The eight months of my internship have been a pleasant journey, literally and figuratively. I travelled throughout the country, meeting people who are experts in their field of expertise and passionate about their work. I feel honoured that they have invested time and effort to share their knowledge and insights with me. They all contributed to an experience which was unique in both a professional and personal way.

This study could not have been conducted without the help of several contributors. I would like to thank my supervisors, Wim Dijkman and Jerry van Dijk, for their help and assistance, critical view and valuable insights. I also thank the employees of CLM for their support and pleasant company during my internship. And, of course, the people who have inspired me during the development of this study. The ideas and proposals in the study have derived directly from them. Thanks to Wouter Rozendaal (Aequator), Johan Absil & Wilbert Smulders (Boerenbond Deurne), Grietsje Hoekstra (CONO), Cees Witkamp (Dutch National Bird Protection Society), Jos Roemaat (Foundation for Natural Rural Areas), Ben Hermans (Foundation for Nature & Environment), Herman van Bekkem (Greenpeace), Hugo van de Baan (IPO (Inter-provincial Consultation), Gerbrand van 't Klooster (LTO region north of the Netherlands), Jan Gerrit Deelen (Ministry of Economic Affairs), Doeko van 't Westeinde (NAJK), Arnout Venekamp, Auke Postma & Dirk Jan Immenga (Province of Drenthe), Adrie Geerts (Province of Noord Brabant), Arjan Ausma (Rabobank), Pieter Brooijmans (Royal Cosun), Jan Bouwman (Syngenta), Albert Jan Olijve (Skylark Foundation), Misha Mouwen (Waterboard of Aa en Maas), René Nij Bijvank (Waterboard of Vechtstromen), Jack Verhulst (ZLTO), Jan Okko Bosker, Fokko Buining, Tonny Doornbos, Jan Willem Kok, Harry Kremer, Dirk Nigten, Henk Smith & Henk Tiesinga (ANOG), Mariët Reins & André Kloet (farmers from Tholen), Jan Klaasen, Peter van der Kruis & Antoine Rieswijk (farmers from southeast Brabant).

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Abstract

The CAP, originally established to improve agricultural productivity, has transformed into a policy aiming to balance economic profits with environmental and societal benefits. The CAP could be a promising instrument to address the EU's goals for climate, biodiversity and water quality. However, the current effect of the CAP on the environment is questionable. This study aims to provide for an evaluation on the CAP's effectivity for environmental sustainability, and gives recommendations on how its effectivity could be improved. The input for this study was provided by literature and interviews with stakeholders and farmers. Agro-environmental measures and behaviour change strategies were identified, followed by a proposal on how these elements can be stimulated through a reshaped organizational structure

Although agriculture is dependent on our natural environment, intensification and industrialization has led to exhaustion of natural resources. This has far-reaching consequences, for the ecosystem functioning, agriculture continuation and human welfare. However, the CAP lacks focus on the environmental focus issues that are of value for sustainability; Soil (soil erosion, soil compaction, organic matter, availability of nutrients and artificial fertilizer use), landscape, nature and biodiversity, climate and air, and water (quality and quantity).

Stakeholders agree that agriculture needs to become more sustainable, but they do not agree on how greening can be implemented on farm level. A categorization can be made in stakeholders aiming at climate, biodiversity, water, soil or a combination of various issues. Although some argue that we need to focus on one element; most stakeholders feel we need to target all recommended issues, through a cycle-approach. Farmers also agree on the need for a broad view on greening and application of a cycle-approach. The cycle based approach as proposed by Hees et al., (2009) offers a promising example.

The CAP currently does not effectively change farmers' behaviour. The three types of farmers; frontrunners, followers and critics, can be motivated more effectively by integrating information techniques, positive motivational techniques, coercive techniques, common marketing strategies, increasing freedom of choice and choosing an effective actor of change.

The CAP's organisational structure can be reshaped in order to support the implementation of effective agro-environmental measures and behaviour change techniques. Five recommendations are defined for a more effective CAP structure: Anticipate on the changing role of the CAP, achieve more effective greening with farm-specific measures, facilitate bottom-up initiatives, aim at diversification instead of McDonaldization and include all actors in the field.

Two scenarios are proposed on how the CAP could be reshaped in order to become a more effective policy for increasing sustainability in agriculture. Focus lies on more financial resources transferred to pillar 2, more possibilities for stakeholders to participate in the CAP, increase availability of different greening measures, allow for Member States to initiate a customized POP program and address market prices not through CAP but other regulations.

1 Introduction

Agriculture provides us with food, forage, bioenergy and pharmaceuticals (Power, 2010), the production of which relies heavily on ecosystem services, provided especially by soil, water and (local) climate conditions (Zhang et al., 2007). The availability of these natural resources is dependent on various natural processes, such as carbon sequestration, nutrient cycling, soil structure and functioning, water purification and functional biodiversity. In order to secure the continuation of agriculture, natural resources and related processes need to be preserved and supported. However, due to growing intensification and industrialisation, the opposite is now occurring; agriculture is exhausting its resources, resulting in the sector becoming more dependent on external inputs, and more susceptible to lack of resources. Additionally, the increasingly disfunctioning ecosystem services have environmental and societal costs far beyond the boundaries of agricultural areas (Stoate et al., 2009; Tscharntke et al., 2009; Geiger et al., 2010; Millenium Ecosystem Assessment, 2005; Pendolovska et al., 2014; Power, 2010).

EU Member States attempt to anticipate on this issue by putting sustainable use of resources on the agenda; thereby securing long-term food security and reducing environmental and societal costs of agricultural production systems. Climate change and energy sustainability is one of the five headline issues for 2020 (European Commission, 2014b), reversing biodiversity loss and creating a resource efficient and green economy is an integral part of the Europe 2020 Strategy (European Commission, 2011), and water quality is addressed through the Water Framework Directive (WFD) (European Parliament, 2000). These issues are addressed through EU policies and legislations such as directives on habitats, birds, water and nitrate. However, the Common Agricultural Policy (CAP), being the most important policy for regulating the agricultural sector, offers a broad influence on various agriculture-related environmental and societal issues. It provides finances, policy mechanisms and control systems with higher environmental impact than all other policies and directives (Pe'er, 2014). The CAP can therefore be of great importance for achieving the EU's 2020 goals within the scope of agriculture in the EU.

Originally, the CAP was established in 1962 to improve agricultural productivity, while enabling farmers to generate a reasonable income. Intensification and upscaling of agricultural practices was aided by CAP subsidies. Since the '60's, different challenges have emerged, partly due to the initiated agricultural intensification (European Commission, 2012; Pe'er, 2014). Overproduction occurred in the '90's and - more recently - a growing concern has emerged regarding the impact of agriculture on the functioning of ecosystem services and availability of natural resources. This has led to the CAP introducing 'greening measures' in 2014; 30 percent of the farmers' income support can only be claimed if the farmer complies with three greening requirements, which

demands a more resource-friendly agricultural management (The European Commission, 2014a; European Union, 2013).

The CAP, originally established mainly for economic objectives, has now evolved in a policy aiming to balance economic profits with environmental and societal benefits; i.e. a more sustainable agricultural sector. Various stakeholders and experts have expressed criticism on the effectivity of the integrated greening measures for a more sustainable agriculture. This criticism is directed mainly at the CAP's organisational structure and the impact of proposed agro-environmental measures for 'greening' (Snoo, 2015; Natuurbericht, 2014; Pe'er, 2014).

During the first six months of 2016, the Netherlands will chair the EU. The evaluation of the CAP has been put on the agenda, but a structured and broad evaluation of the CAP's efficiency for greening, involving a variety of expert opinions, is still lacking. This study aims to provide for such an evaluation, by answering the following research questions;

1. What is the effectiveness of the CAP for a more sustainable agricultural sector?
2. How can the CAP become a more effective instrument for a more sustainable agricultural sector in the future?

Focus of this study is on common agricultural practises in the Netherlands, which is a modern and intensive form of arable and livestock farming. Subsistence farming, forestry, fishery and horticulture are not addressed. Literature, as well as in-depth interviews - with a broad variety of stakeholders as well as several farmers - provided the input for the analysis and results. Since the aim of greening measures is to improve environmental sustainability, this study will focus on the environmental component of sustainability, and not – or to a lesser extent – examine the social and economic aspects.

During interviews with stakeholders, technology (represented by agro-environmental measures), behaviour change and organizational structure were frequently mentioned as being the three main drivers of change towards a more sustainable agriculture. As a result, these three components were chosen as focus elements to address in this evaluating of the CAP. The organizational structure of the CAP is considered as an initiating instrument to stimulate the development of technology and behaviour change. In this report, first the technology will be discussed (agro-environmental measures which are necessary to increase sustainability), followed by behaviour change techniques. Thereafter, recommendations will be proposed on how the organizational structure of the CAP can be optimally equipped to stimulate the other two elements. Two different scenarios are proposed, one is a slightly adapted version of the current scenario, and the other is a more different approach to the CAP of the future.

The framework of this study is formed by the following sub-questions;

1. What is the role of the CAP in the past and present, how is it structured and what is its expected environmental impact? *(Chapter 3)*
2. What is the effectiveness of the CAP for EU's 2020 goals on sustainability and biodiversity? *(Chapter 3)*
3. What are the recent trends in the interaction between agriculture, environment and society? *(Chapter 4)*
4. Which environmental focus issues need to be addressed by agriculture? *(Chapter 4)*
5. How can the CAP address greening, according to stakeholders, farmers and literature? *(Chapter 5)*
6. How can the CAP affect farmers' decision making in favour of sustainability? *(Chapter 6)*
7. How can the CAP's organisational structure support environmental sustainability? *(Chapter 7)*
8. How can the CAP be reshaped in the future, to increase its effectiveness for a more sustainable agricultural sector? *(Chapter 7)*

2 Method

In this research, literature, as well as stakeholders and farmers were consulted, using questionnaires to obtain their insight in how we can make the agricultural sector more sustainable by using the CAP as a policy instrument. The method consists of roughly three phases; the starting phase, interviews with stakeholders and interviews with farmers. These are described below.

2.1 Starting phase

The goals of the CAP for agriculture in past, present and future as well as its impact were studied using (reviewing) literature. To become familiar with the current challenges in the Dutch agricultural sector, several symposia were attended and literature and general agricultural news sources were studied. This preliminary study evoked questions, which were used in the interviews in the next stage of the study.

2.2 Interviews with stakeholders

The Dutch agricultural sector comprises various stakeholders. The aim of this study is to provide for an evaluation of the CAP that is highly representative for the current status of agriculture, and thus involving insights and opinions from a wide variety of stakeholders. This variety was established by selecting participants with different objectives, tasks and incentives, operating in various scales, regions and agricultural sectors. Questions, derived from the research topics described in chapter 1, were used to determine the opinion on the future of agriculture of several stakeholders in the field. The questionnaires can be found in appendix 1, 2 and 3. The participating stakeholders are shown in table 2.1.

Table 2.1 Representatives of stakeholders who participated in the study

Category	Organisation	Representative(s)
Consultancy	Aequator	Wouter Rozendaal
(Financial) Supplier	Boerenbond Deurne	Johan Absil & Wilbert Smulders
	Syngenta NL	Jan Bouwman
	Rabobank	Arjan Ausma
Trader	CONO	Grietsje Hoekstra
	Royal Cosun	Pieter Brooijmans
NGO	Dutch National Bird Protection Society	Cees Witkamp
	Foundation for Natural Rural Areas	Jos Roemaat
	Foundation for Nature & Environment	Ben Hermans
	Greenpeace	Herman van Bekkem
	Skylark Foundation	Albert Jan Olijve
Government	IPO (Inter-provincial Consultation)	Hugo van de Baan
	Ministry of Economic Affairs	Jan Gerrit Deelen
	Province of Drenthe	Arnout Venekamp, Auke Postma & Dirk Jan Immenga
	Province of Noord Brabant	Adrie Geerts
	Waterboard of Aa en Maas	Misha Mouwen
	Waterboard of Vechtstromen	René Nij Bijvank
Farmers' advocacy organization	LTO region north of the Netherlands	Gerbrand van 't Klooster
	NAJK (Dutch Agricultural Youth Organisation)	Doeko van 't Westeinde
	ZLTO	Jack Verhulst

These interviews were of an exploratory nature, intended to collect information, experiences and opinions of the stakeholders on the greening aspects of the CAP and their proposals whether and how these greening of agriculture can be improved. Due to the great variation in stakeholders, a range of opinions was found in the interviews. As described by Turnhout and Lijster (2015), this range of opinions is originated in a diversity of interpretations about - and approaches towards sustainability. Some generalized concepts, such as sustainability, can evoke several different ideas and frameworks. This is referred to as 'discourse'; an ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices. Discourse is different from discussion: a discourse refers to a set of concepts that structures the contributions of participants to a discussion (Hajer, 1997).

The differences in discourse among the participants was evaluated for the terms 'sustainability' and 'greening'. Furthermore, the opinion on how greening should be achieved was further examined. The collected information gathered in these 'start-up' interviews was also used to develop the questionnaires for the next research phase.

During the interviews, repeatedly the need for technological measures, farmers' behaviour change and a well-structured organization to enact a change in agriculture was mentioned by

stakeholders. This categorization is often referred to in the field of (sustainable) change-oriented business management (Managementsite, 2015). The theory is based on the idea that in order to achieve a change, we must focus on changing behaviour, offering technology and change organisation (figure 2.1). This theory will form the foundation for the evaluation of the CAP's effectivity, and can be linked to the sub questions as formulated in the introduction;

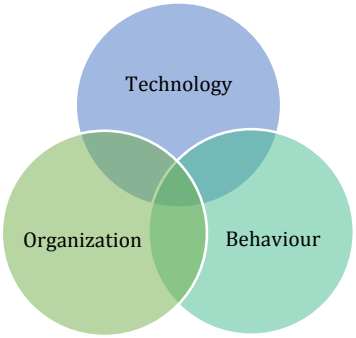

Figure 2.1 The three essential focus elements for achieving change

Technology: What is the effectiveness of the CAP for targeting environmental focus issues, and how can its effectiveness be increased?

Behaviour: What is the effectiveness of the CAP for farmers' behaviour change, and how can its effectiveness be increased?

Organization: Is the organizational structure of the CAP optimally equipped to increase sustainability, and how can its structure be improved?

2.3 Interviews with farmers

Followed by the exploratory interviews with stakeholders, a variety of farmers throughout the Netherlands were approached to participate in focus groups, for in-depth conversations about their insights in sustainable agriculture and the CAP. These conversations were held in the east of Groningen, Tholen (Zeeland) and the southeast of Noord Brabant. The three regions were selected to obtain a wide variety in farmer types, from different sectors (arable vs. cattle) and different regions and biophysical conditions. The participants are shown in table 2.2.

Region	Participant
East-Groningen (ANOG)	Jan Okko Bosker
	Fokko Buining
	Tonny Doornbos
	Jan Willem Kok
	Harry Kremer
	Dirk Nigten
	Henk Smith
	Henk Tiesinga
Tholen (Zeeland)	Mariët Reins
	Andre Kloet
Southeast of Noord Brabant	Jan Klaasen
	Peter van der Kruis
	Antoine Rieswijk

Table 2.2 Farmer participants

The ANOG is a well-known agricultural nature conservation organization, located in the **east of Groningen**. In this region, we find three different soil types; peat soils, clay soils and sabulous clay. The organisation is actively participating in several expertise networks and published several relevant reports. One study offers some valuable recommendations on improving greening measures. Among the ANOG farmers participating in the study were 6 arable farmers (of which one organic), 1 non-commercial nature farmer and 1 citizen (volunteer).

Tholen is a region in the province of Zeeland. This region, with high groundwater levels on clay soils, is very suitable for arable farming and flower seed production. Two farmers from this region have participated in the study; one arable farmer and one owning a farm with arable farming and beef cattle.

The southeast of **Noord Brabant** is characterized by relatively poor, sandy soils with low groundwater levels, resulting in a high proportion of intensive livestock farms. Participating farmers from this region are 2 dairy farmers and 1 farmer mixing arable farming with organic beef cattle and agricultural nature conservation.

During this interview, participants were asked to;

- Review the conclusions on CAP's effectiveness, which were based on the interviews with stakeholders;
- review agro-environmental measurements found in literature and mentioned by stakeholders;
- share their opinion on the organisational structure of the CAP and propose improvements to this system;
- propose agro-environmental measures which could be added to current subsidized measures in the CAP;
- share their personal motives to strengthen sustainability of their farming practices.

3 The Common Agricultural Policy

3.1 EU goals for sustainable agriculture

The European Union (EU) attempts to anticipate on the influence of agriculture on several environmental issues. 'Climate change and energy sustainability' is one of the five headline subjects for 2020 (European Commission, 2014b), reversing biodiversity loss and creating a resource efficient and green economy are an integral part of the Europe 2020 Strategy (European Commission, 2011), and water quality is addressed through the WFD (European Parliament, 2000). The Common Agricultural Policy (CAP) is the most important policy for regulating the agricultural sector, and can therefore be of great importance for achieving these 2020 goals within the scope of agriculture in the EU.

3.2 The role of the CAP in past, present and future in the agricultural sector

An estimated twelve million farmers form the base of the European Union's agricultural sector. The sector has always been of great importance for the economy and society of many countries, since it produces food, creates the landscape of the countryside and manages the environment and our natural resources (European Commission, 2014a). In 1957, The Treaty of Rome acknowledged this importance by instituting the European Economic Community to provide for affordable food for EU citizens, as well as a fair income for farmers. Following this development, the CAP was established in 1962, further emphasizing the need for a stable and healthy agricultural sector. Primary aim of this policy was to improve agricultural productivity, while enabling farmers to generate a reasonable income. Sustainable use of natural resources was not included in the original targets.

The CAP has been reformed many times, hereby following or being ahead of trends in the sector. The first reform was needed in its early stages, when the policy was so effective that more food was produced than needed. Therefore, measures to equalize both supply and demand were introduced in 1992. Over time, more challenges have emerged for the agricultural sector. Therefore, various topics have been added to the CAP, such as producer support, food quality, rural development, and support of developing non-EU countries (European Commission, 2012). In recent times, a growing world population, climate change and degradation of natural and semi-natural landscapes ask for a new approach towards agricultural management. This is why climate change, energy, reversing biodiversity loss and creating a resource efficient and green economy are all important subjects within the Europe 2020 Strategy. The new CAP (reformed in 2013) aims to integrate this strategy, by ensuring an efficient and sustainable way of producing

food and increasing revenues while preserving natural resources (The European Commission, 2014a; European Union, 2013). Opinions vary if the new CAP will be effective in achieving this new goal. There are also concerns about the decreasing budget of the GLB in recent years, among stakeholders it is expected that the fund will further decrease in the future. The next paragraph will describe the structure of the new CAP, including its measures targeting environmental issues.

3.3 New CAP – pillar 1

3.3.1 Organisational structure

The CAP includes three dimensions, divided into two pillars; pillar one contains market support and income support, and will be discussed in this paragraph. Pillar two will be discussed in 3.4. Farmers can receive a basic level of income support, when they are actively running their business and follow cross-compliance standards. These standards are described in the statutory management requirements and the Good Agricultural and Environmental Conditions.

Before, income support was entitled to farmers without any form of service, except of course that the farmer had to be a registered farmer. The more he produced, the more income support he received. Now, this income support is linked to hectares instead of production, which for some farmers has major implications for the amount of income support. But probably the biggest change in the CAP is that for a part of the income support, farmers now need to implement environmental-friendly measures into their business plan. This part of the income support is referred to as 'green payment'. These measures are so-called 'community services'; services that benefit the whole community but are costly for the farmer. But with this subsidy system of the CAP, the community supports the farmer in these services through taxes.

Additionally, it is possible to receive extra support in case a farmer is young. The EU defines the majority of the support regulations. The different types of support are shown in figure 3.1.

Table 3.1 Different types of payment support as described in the new CAP (source: European Commission, 2014a)

In 2015, EU farmers can benefit from:	
Compulsory Measures for the whole EU	**Optional Measures (MS Choice)**
- Basic payment	- Additional payment for the first ha
- Green payment	- Coupled payments
- Young farmers payment	- Payments for less favoured areas
All payments depend on cross-compliance OR Simplified payment for small farmers (MS Choice)	

In pillar 1 of the CAP, the topics climate change, energy, reversing biodiversity loss and creating a resource efficient and green economy are all integrated by use of the green payment possibility. To receive a green payment, farmers must comply with the following 'greening' requirements;

- Diversification of crops
- Preservation of permanent pasture
- Use at least 5% of their farmland for ecological focus area (EFA).

Organic farmers do not need to fulfil these requirements. Additionally, other green measures can be defined by State Members to be equivalent to the original measures. In the Netherlands, the initiatives of the Skylark foundation (Stichting Veldleeuwerik), bird farmlands Montagu's harrier (Vogelakkers Grauwe Kiekendief) and Biodiversity+ (Biodiversiteits+) have been approved to be 'equivalent measures' and qualify for adapted greening requirements. The structure of pillar 1 is shown in figure 3.1.

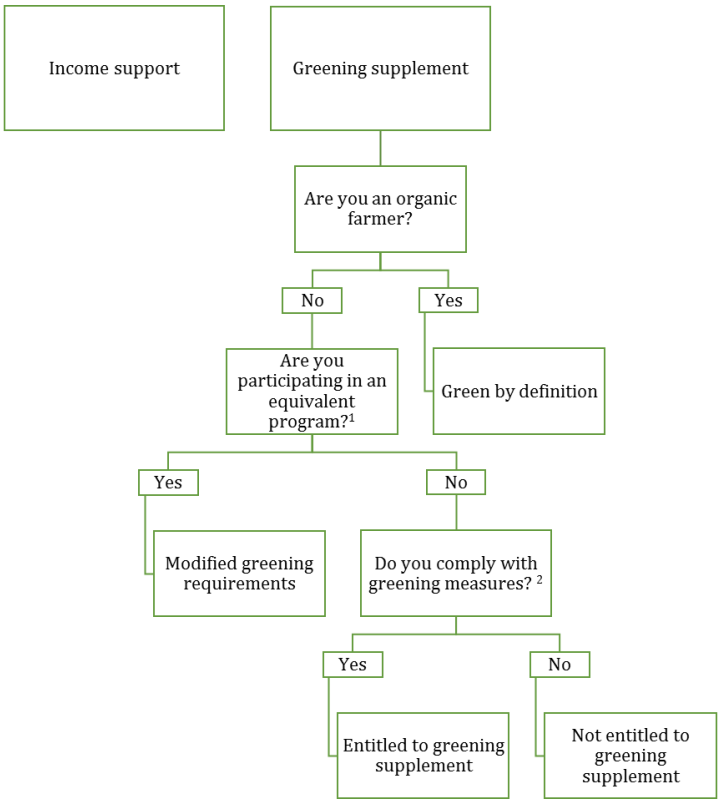

Figure 3.1 Current structure of pillar 1

[1] Skylark foundation, Bird farmlands Montagu's harrier or Biodiversity+ programmes

[2] Diversification of crops, preservation of permanent pasture and use at least 5% of farmland for ecological focus area (EFA)

3.3.2 Impact on environmental sustainability

For the Netherlands, every year about 220 million euro is available for green payments (roughly 30% of 732 million). There are three greening measures, focusing on different elements of sustainability. First, the greening measures will be explained, including a short explanation of the underlying argumentation in favour of the effectiveness of the measures.

Maintain an area of permanent grassland; this measure aims to prevent soil erosion and carbon release through creating carbon sinks.

> **Impact:** Permanent pasture are grasslands that have been so for 6 years or more. When grassland is classified as permanent, farmers are not allowed to convert it anymore. As a result, many Dutch farmers now convert their pastures every 5 years, to prevent it from becoming classified as permanent. Dutch government announced only a decline of 5 percent of grassland is permitted compared to 2012. Rupture of grassland, followed up by the sowing of new grass in the same plot is allowed (which keeps it from being classified as permanent). Furthermore, grassland is not required to remain at the same location. Many farmers convert their pastures to arable land and back into pasture after a few years. The total surface area of grassland then could remain the same. Only 55.000 hectares (5.6% of total pastures) is excluded from rupturing by this greening regulation (peat meadows).

Apply methods of crop diversification; main goal is to avoid monocultures and increase diversity of crops and thereby agricultural biodiversity. Farmers are obliged to grow at least 3 different crops, with the largest crop covering no more than 75% of his arable area. Note that this measure is not restricting farmers to grow the same crop for multiple years on the same plot.

> **Impact:** Only farmers with more than 30 ha of land need to fulfil this requirement. Most arable farmers already grow three crops or more. The impact on the Netherlands is not known, however for the EU the measure will probably affect 2% of total arable areas (Westhoek et al., 2012).

Keeping 5 % of farmland as 'Ecological Focus Area' (EFA); farmers manage a small part of their land to increase biodiversity. This area also improves landscape quality and can act as carbon sink.

> **Impact:** The EFA measure will lead to about 33500 hectares of EFA's in the Netherlands, which corresponds to 1.8 % of total agricultural area (Sevenster, 2014). The impact is also dependent on the design of the EFA's. This is not yet known, although it is expected many farmers will choose for an implementation with green manures. These crops have

a very limited positive effect on biodiversity, according to seven green organisations in the Netherlands (Vogelbescherming et al., 2014).

3.4 New CAP – Pillar 2

3.4.1 Organisational structure

Pillar two covers rural development and it is the only CAP component for which every Member State can develop its own program (European Commission, 2014a). This program must focus on at least four of the following priorities:

- Knowledge transfer and innovation in agriculture, forestry and rural areas
- Farm viability, competitiveness of all types of agriculture in all regions and the promotion of innovative farm technologies and sustainable management of forests
- The organisation of the food chain, including the processing and marketing of agricultural products, animal welfare and risk management in agriculture
- Restoring, preserving and enhancing ecosystems that are related to agriculture and forestry
- The promotion of resource efficiency and the shift towards a low-carbon economy in the agricultural, food and forestry sectors
- Promoting social inclusion, poverty reduction in, and the economic development in, rural areas.

The EU approved the rural development plan (POP3) of the Netherlands in spring 2015. Through POP3, farmers can receive subsidy for participating in certain activities and carrying out environmental-friendly management. EU resources provide half of the subsidy; the other half needs to be provided by national governments. In POP3, for the following activities funding is available;

- Knowledge transfer and education
- Investments
- Agro-environmental measures and climate support
- Collaboration
- LEADER (stimulating collaboration in rural development projects)

Frameworks, set by EU and the government, determine which activities receive funding. But local governments decide which specific activities will actually receive support. Thus, they can decide to focus on certain targets within their region. Furthermore, agro-environmental measures are only subsidized in so-called 'key areas', where opportunities for ecological added value are

expected to be highest. The structure of pillar 1 is shown in figure 3.2.

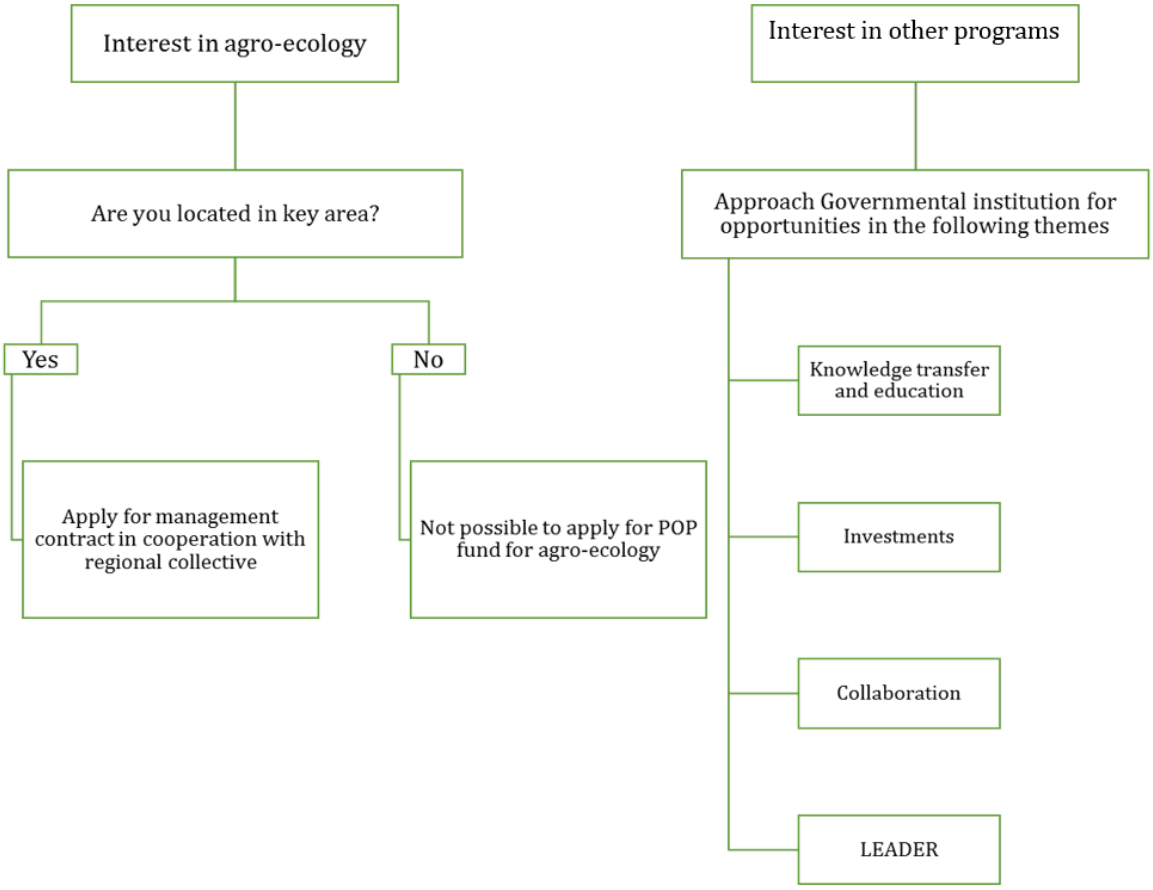

Figure 3.2 Structure of pillar 2 in the Netherlands

3.4.2 Impact on environmental sustainability

For the POP3, 280 million euro is available for knowledge transfer and education, investments, agro-environmental measures and climate support, collaborations and LEADER projects. Focus in the projects must lie in innovation and sustainability. Provinces determine which projects are submitted for funding.

Impact: According to a report from Silvis et al. (2012), the previous POP (POP2) was estimated to be of significant influence on its agricultural goals. This was determined by evaluating seven indicators; economic growth (-/+), increase employment rates (-/+), agricultural productivity (+/-), reduce decrease in biodiversity (-), preserving agricultural areas with high ecological value (+), improve water quality (+) and reduce climate change (+).

3.5 Differences between pillar 1 and 2

For Dutch farmers, fewer resources available for pillar 2 compared to pillar 1 (table 3.1). This difference is not obligatory; it is possible for a national government to transfer resources from pillar 1 to pillar 2 as well as adding extra national funding into pillar 2. For example, Sweden will use nearly 4.8 billion euros for its rural development plan, while having a total of 419 million euros available for its direct payments in pillar 1.

Table 3.1 Total resources for co-financing POP3 2014-2020 – x 1 million Euros (national and EU resources combined) (source: Rijksoverheid 2014)

Year	2014	2015	2016	2017	2018	2019	2020	Total
Total resources financing POP3 (including EU resources)	17.6	35.2	37.6	29.4	51.4	27.2	27.2	280
Total resources financing income support	810	793	781	768	756	744	732	732

Another difference can be found in the way both pillars approach their target group. Pillar one is targeted at all farmers in the EU and participating is mandatory if farmers wish to receive their income support. Participating in pillar two, on the other hand, is voluntary.

The resources for pillar 1 funding come solely from EU resources. Pillar 2, however is co-funded, which means a part is funded by the EU and the other part by national government. Budget for pillar 1 is expected to decrease in upcoming decades. However, for pillar 2 every country can decide how the budget will develop in the future, since it provides countries with more freedom to differentiate their program.

Pillar 1 is often regarded to as 'basic greening level for the EU'. In other words, the greening requirements apply to all farmers in the EU and therefore define the effort every farmer must at least to in favour of the environment. Pillar 2 must comply with certain standards as defined by the EU, but they certainly give room for greater environmental ambitions, in contrast to pillar 1.

3.6 Conclusions

- The CAP offers promising opportunities to address the EU's goals for climate, biodiversity and water quality.
- Pillar 1 of the current CAP is not expected to have a significant impact on the environment. The permanent pastures regulation might even have a negative impact on grassland quality, especially regarding biodiversity and climate.
- Pillar 2 showed promising results in the previous period (POP2) regarding the preservation of agricultural areas with high ecological value, water quality and climate goals. However, it has not been effective for biodiversity.
- Pillar 1 is funded with a higher budget than pillar 2, however pillar 2 has a more voluntary nature and offers more freedom of choice to Member States and participating farmers.

4 Agriculture, environment and society; an overview of current trends

4.1 How agriculture is inseparably linked with its environment and society

Society depends on the natural environment, since it provides for ecosystem services (Zhang et al., 2007). Ecosystem services are defined as "benefits people obtain either directly or indirectly from ecosystems" and can be categorized in production, supporting, and cultural services. Production services comprise the production of food, fibres and fuel. Supporting services are soil structure, soil fertility, biodiversity, water cycling and nutrient cycling. Examples of regulating services are pollination, pest control, soil water retention and climate regulation. The provision of rural lifestyles and an esthetic landscape are examples of cultural services (Millennium Ecosystem Assessment, 2005). Natural ecosystems also provide dis-services to society, which disadvantages people obtain directly or indirectly from ecosystems, for example through pest damage, diseases transmitted by wild species and competition of wild plants with crops.

Agriculture makes use of ecosystem services. Agriculture can act as an ecosystem in itself, thereby providing for a range of ecosystem services and dis-services as well and influencing nearby ecosystems (Antle & Capalbo, 2002). This concept is defined as the agroecosystem, a site or integrated region of agricultural production, understood as an ecosystem, providing a framework to analyse its complex sets of inputs and outputs and the interconnections of their components (Gliessman, 2007). Society relies on the ecosystem services provided by both natural ecosystems and agroecosystems. Dis-services from agroecosystems to natural ecosystems, for example pollution of water and air, also affect human health. Some dis-services from agriculture directly affect agricultural production as well. For example, when exhausting soil nutrients, crop production could decline.

4.2 Recent trends; how agriculture provides services to its environment and society

Agriculture is a vital part of our community, because it provides us with a wide range of ecosystem services. The EU's farmers provide us with an impressive range of affordable, safe and quality products food, forage, bioenergy and pharmaceuticals. All these goods and services are relevant for human wellbeing. Large quantities of these products are exported to other parts of the world, putting the EU among the world's largest and most productive food and fibre suppliers, and showing its potential for playing a key role in ensuring the food security in the world. The agriculture and food sector account for 7 percent of all jobs and 6 percent of

European Gross Domestic Product. Without farms, our hamlets, villages and market towns would be profoundly affected (European Commission, 2014a). And furthermore, 50 percent of all European species depend on agricultural habitats, including some endemic and threatened species (Kristensen, 2003).

4.3 Recent trends; how agriculture provides dis-services to its environment and society

Before WWII, farms used to have a small 'cycle'; producing their own livestock feed, using manure from a small amount of livestock for the farmers' arable field and selling products to local customers. After WWII, increasing farm productivity and efficiency was high on the Dutch government's agenda to reduce hunger. Sicco Mansholt, minister and commissioner of agriculture after WW2 and a big advocate of large-scale agriculture, initiated a development towards low food prices, through cost-effective and mechanized agriculture and restricting salaries. This new movement was supported by the invention of artificial fertilizer, financial support from the 'Marshall-plan' and – in 1962 – the CAP. At one point is in his later life, Mansholt, starts to regret his own approach. He feared that the new agricultural practises were asking too much of earth's carrying capacity, and were – in the longer term – not favouring farmers due to low payments and expensive loans. (Schrama, 2014; Meerburg et al., 2009).

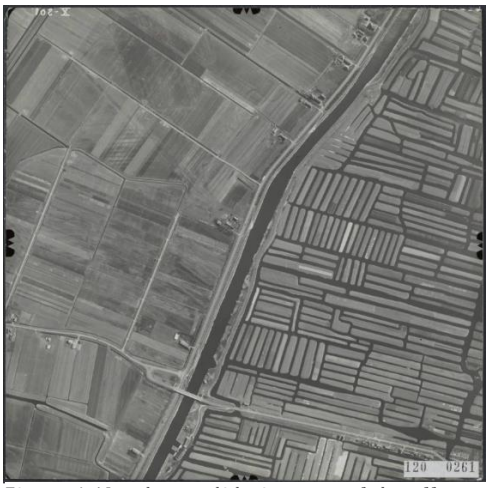

Figure 4.1Land consolidation, one of the effects of intensification and industrialisation of agriculture.

Mansholt is not the only one with concerns. As agriculture relies heavily on natural resources for its production, it is viable for the sector to support and preserve these sources and associated natural processes. There is growing concern for agriculture exhausting its resources, due to growing intensification and industrialisation. Studies show that agriculture is disrupting natural processes, such as carbon sequestration, nutrient cycling, soil structure and functioning, water purification and pollination (Stoate et al., 2009), with effects reaching areas outside production (Green et al., 2005). One example is the environmental contamination by pesticides and fertilizers (Tscharntke et al., 2009; Geiger et al., 2010). The intensification of agricultural land-use has caused a decrease in non-productive areas within the farms (for example, only 2-3 percent is left in the Netherlands), causing a decline in biodiversity (Manhoudt and Snoo, 2003). Effects of EU agriculture are affecting other continents as well, since crops are grown in other

parts of the world and imported to EU farmers to feed their livestock. In the whole world, over the past 50 years, 60 percent of all ecosystem services have declined as a direct result of the growth of agriculture, forestry, fisheries, industries and urban areas (Millennium Ecosystem Assessment, 2005). Agriculture, or – more specifically – the modern intensive agricultural practises (hereafter referred to as 'intensive agriculture') can be held responsible for a major part of biodiversity loss, climate change and degradation of land and water.

The benefits of an efficient, modern and highly productive agricultural system do not always outweigh the costs of its environmental and societal harm. For instance, the environmental costs of all N losses in Europe have recently been estimated at €70–€320 billion per year. This exceeds the direct economic benefits of N in agriculture. The costs are due to losses in air quality, water quality and especially human health (Sutton et al., 2011). At a global scale, sevenfold increase in nitrate-fertilizer application from 1960 until 1995 resulted in doubling of cereal yields, however efficiency declined from 70 to 25 kg grain per kg nitrate (Keating et al., 2010). Soil degradation has been estimated to affect 16–40% of terrestrial area (Chappell and LaValle, 2011) and even for Europe, meaningful soil losses causing reduced yields are predicted for the coming century (Banwart, 2011).

Negative perceptions of agriculture have been adopted by the Dutch society, which has lost connection with its agricultural sector (Meerburg et al., 2009). Due to the overemphasis on efficiency, modern industrial agriculture never has been embedded comfortably in its ecological and social context (Hardeman and Jochemsen, 2012). Societal acceptance of large-scale production systems has declined, resulting in a continuous pressure of citizens on their political and representatives in agricultural decision-making. Farmers are experiencing pressure from market forces to further upscale their production systems, and a contradicting pressure from society to become more extensive and sustainable in order to retain their 'license to produce' (Meerburg et al., 2009, Stoate et al., 2009; Benard and Cock Buning, 2013; Elgersma, 2015; Fish, 2013). We can conclude that, due to dis-services from agriculture, the availability of natural resources and the acceptance of agricultural practices by society can no longer be taken for granted in the future. Measures are necessary to make agriculture more sustainable and safeguard its continuity in the future.

4.4 Environmental focus issues

This paragraph will define the environmental focus issues that need to be addressed in order for agriculture to become more sustainable.

4.4.1 Soil quality

The 68th UN assembly has declared 2015 the International Year of Soils (IYS) to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions. This is necessary, since soil fertility is under increasing pressure.

Soil erosion is a threat to soil fertility and eventually may lead to an irreversible loss of natural farmland. The main causes of soil erosion are inappropriate agricultural practices, deforestation, overgrazing, forest fires and construction activities. The erosion rate is sensitive to climate (change) and land use, with the Mediterranean being the most sensitive region in the EU (Jones and Montanarella, n.d.).

Agricultural practises are causing **soil compaction,** or the deterioration of soil structure that is caused by mechanical pressure. A recent study shows that soil compaction is increasing, and expected to further increase in the upcoming years if no measures are taken (CLM and Alterra, 2015) Compaction of soil causes destruction increased erosion risk and reduced water infiltration capacity, biological activity, porosity and permeability. Decreased yields and increased problems with waterlogging are the result. The increasing wheel loads in agriculture in recent years increased soil compaction in the EU. Low inflation pressure, well-designed tracks, improved steering systems, adapted ploughs, using permanent traffic lanes are examples of possible solutions (Hols, 2015; Vermeulen et al., 2013).

Farming has resulted in 45 percent of European soils having lost significant amounts of **organic matter**, including humus and soil organisms. One of the possible solutions for increasing soil organic matter – and thereby soil fertility – is the use of organic fertilizer and applying no-till farming (Chemnitz et al., 2015).

The **availability of nutrients,** especially micronutrients and phosphorus, forms an increasing concern in agriculture. At least 97 percent of phosphate, potassium and micronutrients need to be imported from outside the EU. Boron, iron, copper, manganese, molybdenum and zinc are essential micronutrients for agriculture. For the EU, the topic of micronutrients receives only little attention, however some eastern and southern countries already have a deficiency of zinc (Haes et al., 2012). Worldwide phosphorus reserves will be exhausted in the next 50 – 100 years (Chemnitz et al., 2015). China – holding the greatest phosphorus reserve worldwide – has

restricted exports in 2008 to protect their resources (Smaling, 2012). The use of phosphorus has been reduced with 40% in the EU (figure 4.2) and 72% in the Netherlands from 1985 – 2010.

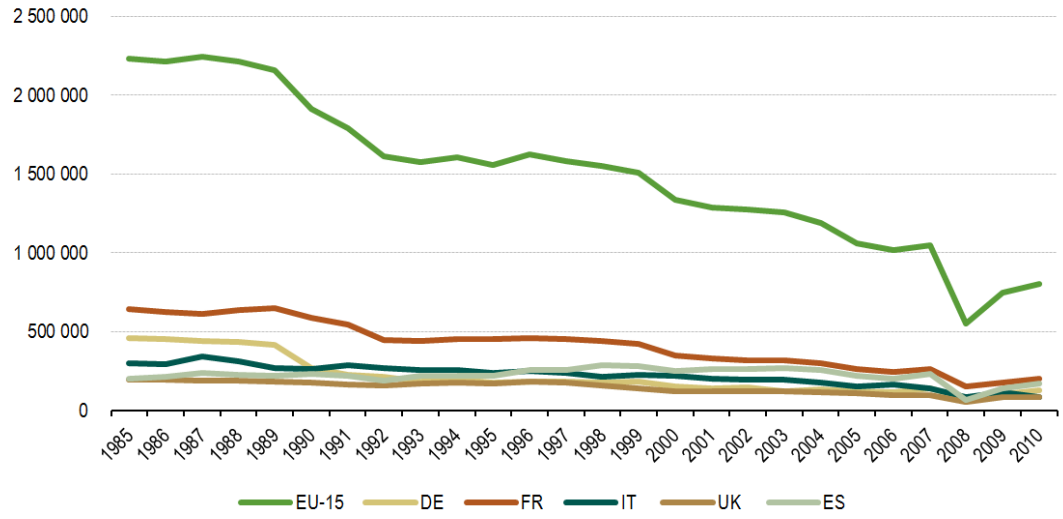

Figure 4.2 Phosphorus use in Europe from 1985 - 2010, in tonnes (source: Fertilizers Europe, 2013)

However, consumption is still not efficient (table 4.1). A yearly excess of 50.000 tonnes of phosphorus remains in soil (40%) and surface water (10%) and is captured in sewage treatment and incinerators (50%) (Smaling, 2012). Much can be gained in efficiency. The most promising approach might lie in the use of natural mechanisms – for example in Mycchorhizal fungi – which are able to extract phosphorus from the environment. However, only little research has been done on these systems (Chemnitz et al., 2015).

Table 4.1 Yearly phosporus balance of the Netherlands (source; Smaling, 2012)

	Phosphorus (P) in tonnes
Artificial fertilizer	10.000
Livestock forage	70.000
Food and manure export	- 28.000
Phosphorus balance	50.000

The use of **artificial fertilizers** is one of the underlying causes for the above-mentioned problems of organic matter and phosphate. In 74 percent of artificial fertilizers, nitrogen is the main ingredient. Most common nitrogen fertilizers are based on ammonia, a chemical that acidifies the soil. This acidification causes a decreased availability of phosphorus. Additionally, nitrogen speeds up the decomposition of humus, causing a decrease in organic matter. Thus, on the short term it might increase soil fertility, but on the long-term it is decreasing it. Artificial fertilizer is also contributing to climate change and it is expensive, with prices expected to increase even more in the future. With using these kinds of fertilizers, farmers become dependent on a few large and powerful fertilizer producers and distributors, with

deposits of exploitable minerals being located in countries where businesses rely on political patronage (Chemnitz et al., 2015).

4.4.2 Landscape

The landscape is a dynamic concept; a result of a continuous interaction between natural processes and human interventions. Cultural, economic and social forces determine these interventions. Landscape has an aesthetic and economic value for humans and a qualitative and quantitative value for biodiversity and climate. A sustainable landscape can be described as a robust landscape, in other words; a landscape that keeps their value for humans and the environment throughout time. In the Netherlands, the landscape has been degrading, mainly because of agricultural intensification and upscaling, increased infrastructure and urban expansion (Herwaarden and Koedoot, 2011). Regarding agriculture, further upscaling is not desirable from a cultural and ecological point of view.

4.4.3 Nature and biodiversity

As described in chapter 1, agricultural environments are managed ecosystems. A wide variety of specialized species and these species in these systems provide for ecosystem services to human populations. However, biodiversity in agro-ecosystems is under pressure. In 2010, the conservation status of only 7% of agricultural habitats and 3% of aboveground species was being recognized as favourable (European Environmental Agency, 2010). Below ground biodiversity – accounting for at least one quarter of all living organisms on the planet, and essential to soil fertility – is recognized to be threatened by land degradation and associated pressures, although exact information on the trends are lacking (Jeffery et al., 2010). The EU has recognized the biodiversity decline; reversing biodiversity loss and creating a resource efficient and green economy is an integral part of the Europe 2020 Strategy (European Commission, 2011). Since biodiversity provides agriculture with ecosystem services, agriculture in itself is threatened by the decline in species diversity.

An excess of **fertilization** threatens biodiversity, more specifically when nitrate and phosphate leftovers from farmlands reside in soil and water. Many plants are sensitive to eutrophic conditions, while some – more generalist species - thrive in a eutrophic environment and outcompete other species, resulting in less plant biodiversity. Animals either rely on (specific types of) vegetation, or are affected directly by nitrate trough high levels in the water, and thus decreasing animal diversity. Eutrophication can form a direct threat to human health as well, since it can cause blooming of toxic algae or when high concentrations of nitrogen in the water cause public health problems (Davis and Shaw, 2006; Smith et al., 1999).

Belowground biodiversity is indirectly affected by **tillage**. Soil tillage operations lead to deep modifications within the soil environment, which in turn is closely related to soil biodiversity. The belowground organic and inorganic processes form the key driver for aboveground biodiversity as well as agricultural productivity. The impacts of soil tillage on soil organisms are highly variable, depending on the tillage system adopted and on the inherent characteristics of the soil. However, in general, less intensive tillage systems are considered to have a positive impact on soil quality and biodiversity (Jeffery et al., 2010; Sheibani and Gholamalizadeh Ahangar, 2013; INRA, 2008).

In the Netherlands, 10 million kilograms of **pesticides** are sold for agricultural purposes annually, which is half of the sales compared to 1985 (Compendium voor de leefomgeving, 2013). Pesticides are, by definition, bioactive, toxic substances influencing – directly or indirectly – soil productivity and agro-ecosystem quality (European Environmental Agency, 2010; Lew et al., 2009). Their impact on biodiversity has become an increasing concern (Kibblewhite et al., 2008). Several types of pesticides have important negative effects on biodiversity (wild plants, carbides, birds, stream invertebrates) (Geiger et al., 2010; Beketov et al., 2013). The environmental impact of pesticides has decreased, although the goal of a reduction of 95 percent in 2010 has not been achieved (30 percent in ground water and 95 percent in surface water) (Compendium voor de Leefomgeving, 2012).

Agricultural plots have grown in the past years. As land values are rising, farmers feel compelled to use every part of their land as efficiently as possible for production. This upscaling has led to the **disappearance of semi-natural environments** and the **homogenisation of crops and landscape**.

4.4.4 Climate and air quality

Climate is an important – if not most important – factor in agriculture, as well as it is for natural ecosystems. Climate change causes water shortages, temperature increases or more extreme storms (Bindi and Olesen, 2011), all strongly influencing agricultural production. Ironically, agriculture is an important driver for climate change, being the second largest greenhouse gas producer of the EU, producing 10 percent of total emissions (Pendolovska et al., 2014). Most greenhouse gasses also act as air

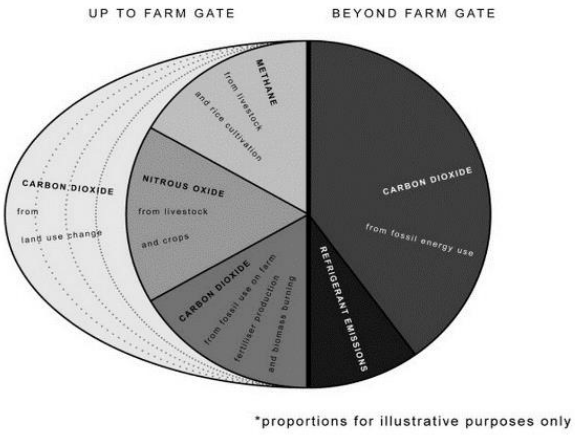

Figure 4.3 Food chain impacts and the distribution of the different gasses (source: Garnett, 2011)

pollutants. Ammonia, for example, forms secondary atmospheric particulate matter, known to provoke 400,000 premature deaths annually in the EU and bringing down the average life expectancy of Europeans by approximately six to twelve months (European Environmental Bureau, n.d.). Figure 4.3 shows how different greenhouse gasses contribute to emissions at different stages in the food chain. In Europe, the European Union (EU) attempts to anticipate on the influence of agriculture on climate change and biodiversity loss. Climate change and energy sustainability is one of the five headline targets for 2020 (European Commission, 2014b). Sustainable climate management can be carried out in different ways, with various measures reducing and/or compensating for greenhouse gas emissions. Since some climate change might be inevitable, measures to adapt to climate change should be taken into consideration as well.

A relatively cost effective way of slowing down the build-up of greenhouse gasses might be to **actively store carbon**, for example by use of agroforestry or using agricultural land as potential sink for carbon by increasing organic matter in the soil, reduced tillage practices, increased cropping intensity, using organic fertilizer, decreased periods of fallow, use of perennial and winter cover crops, recycling of organic wastes, reduced tillage and erosion control (Paustian, 2000; 1992; Cole, 1997; Garnett, 2011)

The use of **alternative energy sources**, such as biofuel, sun and wind instead of fossil fuels could reduce the carbon intensity of fuel inputs. Additionally, the production of biofuel has a considerable potential for the mitigation of CO_2 emissions.

Reducing methane emissions through management practises in ruminant livestock and livestock manures could offer promising management options. Measures improving diet quality and nutrient balance, increasing feed digestibility, and using production-enhancing agents. However, it must be kept in mind that the whole nutrient cycle must be taken into account. For example, replacing concentrated cattle feed with forage might seem to be a suitable measure for increasing reducing methane emissions from the cows' digestion system. However, if the production of these concentrates causes more emissions per product unit, compared to the production of forage, this measure might not be effective. Increasing the age of dairy cows might also be an effective measure, assuming that the extra calves do not increase overall emissions due to 'overproducing' of individual calves. Recently, a new innovative product has been discovered; 3NOP, which is an addition to the forage of cows and persistently decreased enteric methane emissions from dairy cows with no negative effect on milk production (Hristov et al., 2015).

4.4.5 Water

In the EU, goals and regulations for **water quality** are defined in the Water Framework Directive, which was introduced in 2000. Although certain progress has been made since its implementation, a 'fitness check', carried out in 2012 by the European Commission, has confirmed that there is still a long way to go before water quality meets the standards. For half of the surface of the EU's surface waters it is unlikely they will achieve a good ecological status in 2015. Furthermore, there is a data lack for 40 percent of the surface waters, making it impossible to know its current condition (European Commission, 2015). For the Netherlands, agriculture is the most important source of diffuse pollution. Especially **fertilizers** and **pesticides** form a threat to water quality. According to the European Commission, a clear strategy must be formed for the use of fertilizer and pesticides. Farmers must be provided with clear and practical measures (Vewin, 2015).

Water **availability** is an essential component in agricultural practises. Especially the effect of climate change in water availability is an increasing cause of concern in the Netherlands. Experts claim the effects are already noticeable; in the past century, temperatures have risen with 1.7 ˚C, the amount of summer days increased with 20 and the frequency of heavy rainfall increased significantly. It is expected that the Dutch climate will get more extreme weathers, such as heavy droughts or storms. At the same time, ground water in some coastal areas is becoming more salt. Measures to make Dutch agriculture more climate change resistant should focus on effective water management and making arable crops more salt-resistant (Minnen and Ligtvoet, 2012; Roekel, 2014).

4.5 Effectiveness of the CAP for environmental focus issues

In paragraph 3.3.2, the impact of the CAP on the environment was discussed. In the previous paragraph, the agricultural focus issues were determined, which enables to further examine the impact of the greening measures on specific target goals within environmental sustainability.

Pillar 1: As shown in table 4.2, various focus issues are not addressed. Remaining issues are addressed to a minimum extend.

Table 4.2 Effectiveness of greening measures for environmental focus issues

	Environmental focus issues	Solutions supported by Pillar 1 Greening regulations			Current impact of pillar 1 greening regulations
		Permanent grassland	Crop diversification	EFA	
Soil	Soil compaction	x	x	- Use of crops which increase quality of soil structure	On max. 1.8 percent of agricultural area, farmers might increase quality of soil structure
	Organic matter	- Preserve continuation of organic matter fixation by grasslands	x	- Use of crops which increase soil organic matter	- Organic matter might increase in max.1.8% of total agricultural area - Organic matter fixation by pastures will remain or decrease with max. 5%
	Availability of nutrients		x	- Use of crops which are highly efficient in extracting phosphorus and micro-nutrients	On 1.8 percent of agricultural area, farmers might increase quality of soil structure
	Artificial fertilizers	x	x	- Use of nitrogen fixating crops	On 1.8 percent of agricultural area, farmers might increase use of organic fertilizers
Biodiversity	Landscape	x	- Promoting diversity of crops in landscape	- Promoting use of attractive crops (flowering crops)	- Most farmers already meet crop diversification requirements, thus diversity will remain equal - On 1.8 percent of agricultural area, farmers might increase use of attractive and diverse crops
	Fertilization and pesticide use	x	x	- In some of the EFA crops, use of pesticides is prohibited - Promoting use of buffer zone (field margin) - Use of nitrogen fixating crops - Promote use of crops which are associated with above-average biodiversity	- On max. 1.8 percent of agricultural area, farmers might decrease use of pesticides and fertilizer, and increase amount of (functional) biodiversity.
	Availability of semi-natural environments	- Preserve grassland areas and associated biodiversity	x		- Biodiversity in pastures will probably not increase, but however be preserved - In 1.8 percent of agricultural area, biodiversity might increase
	Homogenisation of crops and landscape.	x	- Promoting diversity of crops in landscape	- Promoting use of different crops	- In 2 percent of EU areas, diversity of crops will increase - In 1.8 percent of agricultural area, farmers might use different crops
Climate	Carbon storage	- Preserve continuation of carbon fixation by grasslands		- Use of crops which fixate nitrogen	- In pastures, 39 percent of agricultural area, carbon storage will be preserved, not increased - In 1.8 percent of agricultural area, carbon storage potential might increase
	Use of alternative energy sources	x	x	x	x
	Reducing emissions	x	x	x	x
Water	Storage of water	- Preserving pastures, which increases water retention capacity of the soil	x	- Use of crops which increase soil organic matter; may increase water retention capacity of the soil	- In 41.8 percent of agricultural area, soil water retention might increase due to more soil organic matter
	Water quality	x	x	x	x

The EFA measure offers most opportunities for the various focus issues, however the area it affects is very small (1.8% of total agricultural area, as calculated in 3.3.2.), and its effectiveness

for the focus issues is dependent on how farmers will use this area. It is expected that most farmers will use crops which do not have a significant influence on greening (Belder et al., 2014) and therefore the actual impact of greening measures is not expected to be significant, even in the 1.8% EFA area. Permanent grassland offers some opportunities for nitrogen fixation, and possibly biodiversity associated with pastures. However, as already stated in paragraph 3.3.2, the area of grassland is not expected to increase due to the permanent grassland regulation. Instead, now convert their pastures every 5 years, to prevent it from becoming classified as permanent, resulting in increased nitrogen emissions. Crop diversification is expected to have a minimal impact on landscape heterogeneity. Overall, we can conclude that there are several environmental focus issues which are not yet addressed by pillar 1 CAP.

Pillar 2: Through POP3, basically all agricultural targets can be addressed, dependent on the extent to which there is a demand from co-financing government institutes and – to a lesser extend – from participating actors. It depends on the motivation and knowledge of participants whether all (relevant) environmental focus issues will be addressed. This is dependent on the focus of POP budgets, initiated by the co-financing governments (12 provinces and 23 Water Boards). But during interviews, governmental stakeholders already gave some insights in how the POP3 funds will be spend. The majority of POP3 funds is reserved for agro-ecological and water-quality measures, such as meadow bird conservation, farmland bird conservation or landscape management. But agrobiodiversity and water quality are only a small aspect of total environmental sustainability. As defined in paragraph 4.4, there are various other environmental focus issues that need to be addressed. Some stakeholders also cautiously expressed concerns that the budgets for soil, water retention and climate change mitigation and adaptation might be too limiting for achieving significant improvements.

4.6 Conclusions

- Agriculture has a strong relation with our natural environment, for its continuation it depends on ecosystem services, especially the availability of natural resources.
- Agriculture can act as an ecosystem in itself, being a viable part of our community for providing society with various products and ecosystem services.
- Agroecosystems can provide dis-services, for example through contamination of ecosystems, and exhaustion of soils.
- Due to intensive agricultural practises, the availability of ecosystem services and natural resources cannot be taken for granted in the future. Since agriculture is dependent on these services, the continuation of agriculture is at stake.
- Environmental focus issues which need to be addressed by agriculture in order to safeguard its continuity in the future are; soil, landscape (such as biodiversity), climate, air and water.
- Pillar 1 of the new CAP is not expected to have a significant effect on the defined environmental focus issues.
- Pillar 2 offers some opportunities for addressing the environmental focus issues. However, its focus lies on agro-ecological and water measures. Other environmental issues will probably be attained to a limited extend.

5 Ambitions for a more sustainable agriculture

5.1 Sustainability in agriculture – review of perspectives

Interviews with stakeholders have provided for a deeper insight on their different perspectives of sustainability and greening, motivations to implement sustainable measures and target goals for environmental sustainability.

5.1.1 Discourse in sustainability perspectives

The agricultural sector needs to transfer into a more sustainable system to preserve our natural ecosystems and resources, and safeguard the continuity of food production in the future. It is a sentence which is stated frequently, but sustainability is a definition open to many interpretations. The idea of sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. The concept is appealing to a large public because of its intention, but remains vague about practical ways of reaching its goals (Lichtfouse et al., 2009). As defined by Graham-Tomasi (1991); "These days, just about everyone is on the sustainability bandwagon, and sustainability has come to mean all things to all riders on this bandwagon". This is diversity of interpretations can be referred to as 'discourse' (Turnhout and Lijster, 2015), a term which has been described in the method.

During interviews with Dutch stakeholders, this discourse became evident. Every representative had embraced the concept of sustainable agriculture, and everyone agreed that sustainability should be the ambition of agricultural development. But the interpretations of sustainability varied, and thus eventually it turned out some stakeholders mutually disagreed on the application of sustainability. These interpretations can be categorized using the three components of sustainability as proposed by Elkington (1994); environmental, social and economic sustainability. The choice for one component in particular was made either because the stakeholder genuinely believes one target is superior to another, or deliberately chooses to target a component which they believe represents their role in the field of agriculture best. In general, for 'green' organisations, such as Greenpeace and the Foundation for Nature and Environment (Stichting Natuur en Milieu) environmental sustainability is the main objective. Farmer's organisations, such as LTO and NAJK focus more on economic and social sustainability. For companies such as Royal Cosun and the Rabobank, economic sustainability is the main target. Some organisations also tend to specify their target even more by choosing for one or more specific targets within a component. Governmental institutions try to combine the three objectives.

5.1.2 Commitment and motivation for environmental sustainable development

All of the stakeholders address environmental sustainability to a greater or lesser extent. We can categorize them in sustainability leaders, environmentalists and traditionalists, based on the commitment and amount of motivation to implement environmental sustainability in their organisation, using a slightly adapted categorization as proposed by Hahn and Scheermesser (2006). The categorization is thus not based on accomplishments, but purely on the underlying reasoning to commit to sustainability. The groups are not confined by concrete boundaries. We find a gradual transition from sustainability leaders towards traditionalists.

Sustainability leaders; stakeholders with a strong commitment to sustainable development. Their commitment is mainly motivated by the ethical and moral factors. They feel that we need to preserve and improve environmental conditions because we have a moral obligation as humans to do so. We 'owe' it to our natural environment to treat it with respect and not damage it. Green organisations, such as Greenpeace and the Dutch National Bird Protection Society, are prime examples of sustainability leaders. Their main goal is to increase sustainability, which is originated from a moral obligation that we owe it to our natural world to invest in sustainable development.

> Foundation for Natural Rural Areas: *"Of course we must take care of our natural environment. We could consider it to be our moral obligation; we just have to do it. At the same time, farmers consider it as a service to society. Therefore, they request an extra payment for these services."*

Environmentalists; the relevance of sustainable development is rated lower compared to sustainability leaders. Ethical motivation plays a minor role. Rather they are worried about the continuation of food supply, feel some ecological responsibility, act out of image reasons or aim at cost savings through sustainability reasons.

> CONO: *"Within our sustainability program, we actively search for measures that we can combine with market strategies that positively distinct us from competing parties. One example is our stimulus to increase outdoor cow grazing, implemented in 2002. The measure increased sustainability, enhanced cheese flavour and texture, improved animal welfare and increased our corporate image."*

Traditionalists; although these companies state that sustainable development has a fairly high relevance to them, it is not a priority. Compared to environmentalists and sustainability leaders, they take less initiatives to implement specific cooperative measures. Their commitment is mainly motivated by business goals, such as revenue growth, new market opportunities and a

positive corporate image. Their goals is not to be a leader in sustainability. Moreover, they will address sustainability because there is a demand from (new) markets and/or government.

> Rabobank: *"Sustainability for us is – on the one hand - the way a client manages his business, and – on the other hand – financial sustainability. For us it is about people, planet, profit, and profit should not be a 'dirty word'. Especially when reasoning from a financer's point of view; for us it is especially important that a client company can manage a financial setback."*

5.1.3 Discourse in 'greening' perspectives

In the CAP, the greening measures are implemented to reward farmers for the provision of certain sustainable farming practices (i.e.) environmental public goods (European Commission, 2013). Greening is introduced as a new term, referring to sustainable farming. The term sustainable is already open to different interpretations, and the new term of greening could increase this discourse. During interviews, stakeholders were asked to describe the definition of greening, based on the word only, and thus decoupling it from the connection with the CAP.

When compared with sustainability, the term greening showed more similarities in its interpretation. All stakeholders described greening as representing the environmental corner of sustainability. When asking them how environmental sustainability should be integrated in daily farmer practises, opinions varied. Most stakeholders projected their own environmental sustainability goals and activities upon the goals that the greening measures should be serving. Some stakeholders might focus on ecological - or water measures, while others believe that a broad range of measures is more effective for increasing sustainability on farm-level. This discourse regarding implementation of greening (c.q. environmental sustainability) showed a distinction between climate, biodiversity, water and soil measures, and is shown in table 5.1. Biodiversity is targeted by most stakeholders, climate is addressed the least of all. There is a variation in the number of issues stakeholders commit themselves to.

Table 5.1 Stakeholders' focus area(s) for greening measures in agricultural practices

Climate; mitigating measures

Biodiversity; ecological measures

Water; quality & quantity (climate adaptation)

Soil; increase soil fertility and water retention capacity

Category	Organisation	Climate	Biodiversity	Water	Soil
Consultancy	Aequator	x	x	x	x
(Financial) Supplier	Boerenbond Deurne	x	x	x	x
	Syngenta NL		x	x	
	Rabobank		x		x
Trader	CONO	x	x	x	x
	Royal Cosun	x	x*	x	x
NGO	Dutch National Bird Protection Society		x		
	Foundation for Natural Rural Areas	x	x	x	x
	Foundation for Nature & Environment		x		
	Greenpeace		x	x	x
	Skylark Foundation	x	x	x	x
Government	IPO (Inter-provincial Consultation)	x	x	x	x
	Ministry of Economic Affairs	x	x	x	x
	Province of Drenthe	x	x	x	x
	Province of Noord Brabant		x	x	x
	Waterboard of Aa en Maas		x	x	x
	Waterboard of Vechtstromen		x	x	
Farmers' advocacy organization	LTO region north of the Netherlands	x			x
	NAJK (Dutch Agricultural Youth Organisation)	x	x	x	x
	ZLTO			x	x

*Program for biodiversity is in preparation, will soon be implemented in Unitip sustainability program.

5.1.4 A consensus on 'greening'

There are different perspectives on how to implement greening in farming practices. While some are convinced we should use greening measures only for biodiversity (i.e. ecological measures), others assume that it is a definition suitable for targeting a broad range of sustainability targets. This last opinion is in line with the conclusions from chapter 4, which stated that we need to address a broad range of environmental targets, in order for agriculture to become more sustainable. All four environmental subjects (climate, biodiversity, soil and water) are closely related to each other through various natural processes. Many stakeholders agreed on that, with some of them proposing a system – cycle – or ecosystem services approach in order to combine all targets.

Aequator: *"Nature, landscape, water and soil are all related to each other and to agriculture (…) we should have a broad view towards our natural resources, not only focus on – for instance – nutrient cycles or fossil fuels. For example; landscape is a resource as well."*

ZLTO: *"Soil, water and climate all need to be addressed in order to – eventually – increase biodiversity. All these factors are part of a cycle. Production is a part of the same cycle, and therefore is dependent on these natural processes"*

Waterboard of Aa & Maas: *"Greening should include more than addressing visible nature elements, because abiotic processes form an important influence on biotic elements."*

Ministry of Economic affairs: *"A cycle approach would be suitable, and for farmers this would be a particularly attractive approach for addressing sustainability"*

A system approach for greening measures can affect the whole of our natural environment. Within such an approach, stakeholder with knowledge on different components could complement each other. Farmers may be more interested in a cycle approach than an approach that focuses only on one environmental aspect. A proposal for such a cycle approach will be provided in the next paragraph.

5.2 A system approach for environmental sustainability

Cycle-based agriculture is a concept of farming, a business approach that is adjusted to using resources that are available and produced on the farm. It is a concept emerged in the Netherlands, however it is closely related to the worldwide concepts of External Input Agriculture (LEIA), Conservation agriculture, agroforestry, Shumei Natural Agriculture, Carbonfarmers, Permaculture, Community-supported agriculture, Eco-agriculture and Holistic management.

Examples of the aspects of cycle-based farming are sunlight, minerals, labour, organic matter and energy. Only the essentials of external inputs are used. Farming is carried out with respect for natural systems and aims to provide for a sustainable – long-term – livelihood (Hees et al., 2009). Such an approach can include a broad variety on sustainable ambitions, from farm-level to international level and from climate to soil quality. It is an approach applicable to all types of agricultural practices. Key aspects of cycle-based agriculture are;

- A holistic system rather than a reductionist approach
- A farmer choosing not to participate in the 'rat race' against restrictions, by choosing for a targeted approach towards sustainable agriculture in his region.

- A long-term vision, alluding to continuity rather than yield
- Patience in management system; giving nature time to adapt (slow farming)
- Economies of scope instead of economies of scale
- Conservation of soil(diversity) by balancing fertilization and consuming of nutrients
- A multi-faceted knowledge base; science, experience, intuition.
- Optimizing production while reducing external inputs over a longer period

Examples of a cycle-base measures on the farm level is the use of more fibre-rich forage (instead of concentrated and protein-rich cattle feed), the use of bedding material, less use of artificial fertilizer and delay of mowing, to decrease ammonia emissions. A scheme of the cycle approach is shown in figure 5.1.

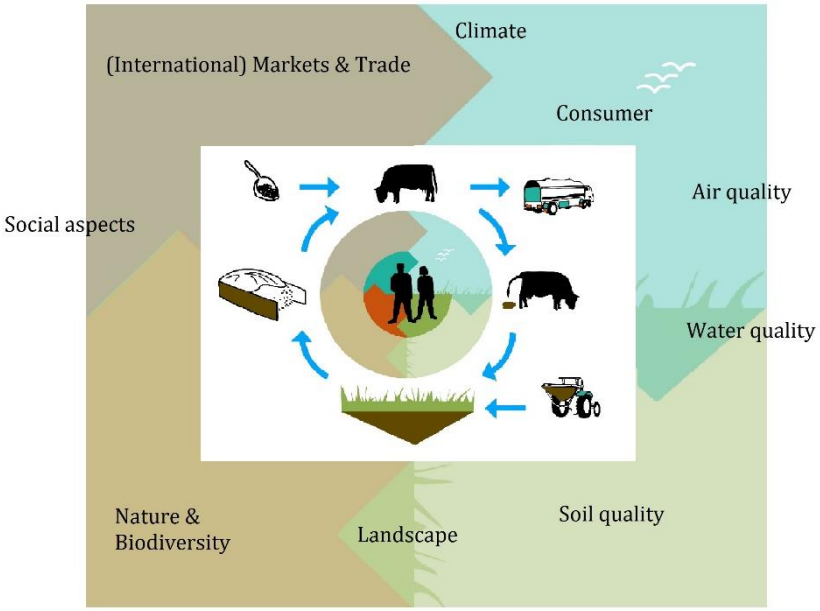

Figure 5.1 Cycle approach towards agriculture (source: slightly adapted version of the figure used in Hees et al., 2009)

All environmental focus issues from chapter 4 can be addressed within this cycle. Additionally, all the ideas and perceptions of stakeholders can be implemented in (a component) of the cycle approach as well. While some stakeholders aim at increasing efficiency in the biophysical elements on a farm, others stress the importance of social aspects, like animal welfare as an important factor for increasing public support.

5.3 Farmers' ambitions for environmental sustainability

Farmers were asked how and which environmental focus issues they would target –specifically for their region - in order to become a more environmental sustainable sector. They identified several issues in their own region that they are personally concerned about (table 5.2). As shown, the issues can be divided over the four elements of greening as proposed in paragraph 5.4.

Table 5.2 Environmental issues in the region, from the perspectives of farmers

	Climate	**Biodiversity**	**Water**	**Soil**
East-Groningen (ANOG)	Expecting larger variations in climate conditions	Decrease in biodiversity and lack of stimulating initiatives	Variations in availability	Soil compaction Organic matter
Tholen (Zeeland)	Carbon storage in soil	Decrease in biodiversity and lack of stimulating initiatives	Salinization Water excess	Soil compaction Soil exhaustion
Southeast of Noord Brabant	Excess emissions of ammonia, carbon and methane	Decrease in biodiversity and lack of stimulating initiatives	Water shortages Excess of pesticides and fertilizer	Soil compaction Soil biodiversity Organic matter Phosphate availability

For these problems, farmers proposed various agro-environmental measures which could offer a solution. These are shown in table 5.3, and the measures supplemented with findings and measures proposed by literature.

Table 5.3 Agro-environmental measures eligible in CAP subsidy system

		Climate	Biodiversity	Water	Soil	Source
Climate	Agroforestry	x	x	x	x	1
	Backfill ground without peat	x				2
	Increase soil organic matter content	x	x	x	x	3, 4
	Use of sustainable energy sources	x				5, 6
	Low emission housing systems	x		x		7, 8
	Sustainable manure storage	x		x		7
	Sustainable forage choices (use of certificated food)	x	x	x	x	9
	Co-fermentation	x				10
	Cattle feed with low methane emissions	x				11
	Sustainable lighting systems	x				12
Biodiversity	Innovative spraying techniques		x	x	x	13,14
	Use of (mixtures) of biodiversity-friendly animal and plant varieties		x		x	15
	Use of species adapted to region-specific characteristics		x	x	x	16,17
	Field margins		x	x	x	18,19
	Use of natural enemies (confusion techniques in fruit)		x	x	x	20,21
	Construct and maintain nesting opportunities for natural enemies		x	x		22
	Growing crops in strips with sustainable crops		x		x	23,24
	Landscape elements	x	x	x	x	25
	Keeping cereal stubble over winter		x		x	26
Water	(Temporary) water storage		x	x	x	27
	Valuable grasslands with high groundwater level		x	x		28,29
	Natural and flexible water level management/drainage			x	x	16
	Use of weirs		x	x		30
	Targeted and efficient watering systems			x	x	16
	Increase of culverts		x	x		30
	Nature friendly banks		x	x		31
	Sustainable land use change in subsidence areas (peatlands)	x	x	x		32
	Spray-free zone		x	x	x	33,34,35,36
	Infiltration ditch		x	x		37
Soil	Minimal tillage	x	x	x	x	38,39,40,41,42
	Nutrient cycling systems	x		x	x	43,44,40,41,42
	No tillage	x	x	x	x	38, 39
	Precision fertilization	x		x	x	46
	Use of green manure crops			x	x	47,48
	Row fertilization	x		x	x	49
	CO fermentation	x			x	10
	Use of N-efficient crop varieties			x	x	47,48
	Continuous coverage	x	x	x	x	50,51,52,53
	Use of sustainable crops (alfalfa, cereals, etc)			x	x	47,48
	Composting		x	x	x	54,55
	Use of train paths			x	x	47,48
	Avoid use of heavy machines		x	x	x	47,48,56
	Umbilical system with manure				x	57

1Rigueiro-Rodríguez et al., 2009; 2 Agriconnect, 2015; 3 Schmidt et al., 2011; 4 CLM and Alterra, 2015; 5 Dickson and Fanelli, 2013; 6 Boerderij, 2015c; 7 Infomil, 2009; 8 Melkvee, 2015; 9 Milieucentraal, 2015; 10 Commissie Deskundigen Meststoffenwet, 2015; 11 Hristov et al., 2015; 12 Maatlat Duurzame Veehouderij, 2014; 13 Spuitdoppenkeuze, 2015; 14 PBL, 2015; 15 Wit and Wagenaar, 2013; 16 Minnen and Ligtvoet, 2012; 17 Roekel, 2014; 18 Bos et al., 2014; 19 ; Steenbruggen et al., 2015; 20 Agriconnect, 2015; 21 Vlaanderen, 2015; 22 Blok et al., 2009; 23 Peeters, 2014; 24 Sukkel, 2014; 25 Herwaarden and Koedoot, 2011; 26 Dochy, 2012; 27 Roelsma et al., 2014; 28 Vliet et al., 2015.; 29 Hoogheemraadschap de Stichtse Rijnlanden, 2015; 30 Noorduyn, 2004; 31 Sollie et al., 2011; 32 Hardeveld et al., 2014; 33 European Environmental Agency, 2010; 34 Lew et al., 2009; 35 Joergensen, 2006; 36 Geiger et al., 2010; 37 Groenblauwenetwerken, 2015; 38 Philips & Philips, 1984; 39 Prahsun, 2012; 40 Jeffery et al., 2010; 41 Sheibani and Gholamalizadeh Ahangar, 2013; 42 INRA, 2008 43 Smaling, 2012; 44 Chemnitz et al, 2015; 46 Wilt and Schuiling, 2011; 47 CLM and Alterra, 2015; 48 Hols, 2011; 49 Nederlands Centrum voor de Ontwikkeling van Rijenbemesting, 2015; 50 Paustian, 2000; 51 Adams et al., 1992; 52 Cole, 1997; 53 Garnett, 2011; 54 Visser et al., 2008; 55 Boerderij, 2015 56 Vermeulen et al., 2013; 57 VBBM, 2015

Farmers were confronted with the ideas of stakeholders, to apply a system approach in order to target climate, biodiversity, water and soil issues as proposed in paragraph 4.4. All farmers agreed to the need for a more broad view on environmental sustainability, arguing it would offer more possibilities, be more effective and would appeal to many farmers.

Southeast Brabant: *"A broader CAP would offer possibilities for measures which have additional value for greening, since 'real' greening requires flexibility for farm-customized approaches."*

Tholen: *"We believe a healthy and sustainable farm starts with a healthy soil. We regret that the CAP does not apply such an approach (…) we strongly feel that the many opportunities for 'real' greening are not addressed by the CAP."*

ANOG: *"The reasoning behind the current greening measures is unclear and its effects are of minimal value for the environment. We believe that farmers can offer many additional measures which really offer results for greening."*

For every environmental issue, they were asked to reflect on they are currently being motivated to apply sustainable measures.

Climate: Current laws and regulations are being perceived as having adverse effect on the level soil organic matter, and thus the fixation of carbon and nitrogen. Some Dutch farmers have invested in windmills and/or solar panels. However, the majority is not triggered to invest (more) in alternative energy sources. Although there are known (innovative) measures to reduce emissions, farmers do not feel triggered by the CAP to implement those.

Biodiversity: Multiple farmers are willing to increase landscape quality, especially through creating and managing of landscape elements. However, landscape elements are not included in CAP subsidy opportunities. Fertilization and pesticide use remains a difficult target to address. Farmers are generally willing to participate in programs that focus on decreasing use of these compounds. Also, multiple farmers are willing to create and manage landscape elements and/or field margins and make landscape more diverse. However, they feel those options are not stimulated enough in current CAP subsidy opportunities. Especially the fact that agricultural nature preservation is not stimulated in pillar 1 (only in pillar 2) is disappointing. Farmers participating in nature preservation schemes, still have to apply to greening measures and they feel this is not fair.

Water: Several farmers are interested in making their lands available for water storage in the winter (this may be a solution for nematode infestation). However, this measure is not yet implemented in the CAP. Soil water retention needs to be further increased, preferably by increasing soil organic matter. Water quality has increased in the previous years, however many farmers believe it can be increased further, preferably by using spray-free zones, new spray nozzles and specific spraying techniques. These measures can be implemented through pillar 2, however a lot of farmers are not aware of these possibilities.

Soil: The underlying causes of soil compaction are not being addressed sufficiently at the moment. Current agricultural trends are expected to increase soil compaction in the future. Current regulations have adverse effect on the level soil organic matter. There are worries about the availability of nutrients, especially phosphorus. Current laws and regulations have adverse effect on the level of nutrients in the soil. Farmers generally prefer organic fertilizer to increase soil fertility and artificial fertilizer as an efficient supplement. Increased quality of organic fertilizer and reliability of its sources could decrease use of artificial fertilizer. Farmers feel an interesting and promising solution might lie in arrangements for manure processing, to decrease emissions and increase soil fertility and belowground biodiversity.

Most of the arguments given by farmers do not necessarily reflect facts. There might actually be more possibilities for sustainable development then they are aware of, or they might not feel motivated to apply these measures. The reflections strongly refer to the psychological effects of the CAP and other environmental regulations. A new approach on how the CAP can increase motivation in farmers will be further discussed in the next chapter.

5.4 Conclusions

- Every stakeholder agrees that agriculture needs to become more sustainable. However, perspectives differ largely between environmental, social and economic sustainability.
- The motivation and commitment for environmental sustainable development varied greatly between stakeholders. Some feel a strong moral obligation to sustainability. Others hardly use any sustainable measures and the commitment is motivated by business goals.
- Greening is a term that every stakeholder agrees to as representing environmental sustainability.
- There are various perspectives on how greening can be implemented on farm level, which can be categorized in climate, biodiversity, water and soil. Some argue that we need to focus on one element; most stakeholders however feel we need to target the whole package of environmental issues.
- Many stakeholders stress the need for a cycle-approach towards greening. The cycle approach as proposed by Hees et al., (2009) offers a promising example of such an approach.
- Farmers agree that we need to target greening through a system approach, targeting climate, biodiversity, water and soil in order to become more sustainable.

6 Influencing farmers' decision making in favour of sustainability

Agriculture is not just a biophysical system. A considerable part of the agroecosystem is determined by human decision-making. This makes an agroecosystem a complex and dynamic "managed ecosystem", with spatially varying inputs and outputs that are the result of interrelated physical, biological and social processes (Antle et al., 2001). It is a social-ecological system, a concept where humans are considered as being part of the biosphere, assuming that the resulting intertwined social-ecological system behaves as a complex adaptive system. The system has the capacity to self-organize and adapt based on past experience, and are characterized by emergent and non-linear behaviour and inherent uncertainty (Biggs and Schlüter, 2015). The management on a farm determines whether an agroecosystem provides for predominantly ecosystem services or dis-services. Environmental-friendly measures need to become embedded within farming cultures as part of conventional 'good farming' practice (Burton and Paragahawewa, 2011). Thus, for a more sustainable agriculture we need to influence farmers' management choices through behaviour changing techniques. The CAP can act as an instrument to increase farmers' motivation for sustainability. As stated by Morris and Potter (1995); a policy scheme should bring about a shift in farmers attitudes towards countryside management that will outlast the schemes themselves.

6.1 The motivations behind decision making

Why would a farmer choose to participate in an agri-environmental scheme, such as the CAP? Research on the motivations of farmers for participation in environmental schemes shows that motivation for agri-environmental schemes is influenced by cultural norms, identity, social and cultural context; values, goals, objectives and principles; and worldviews or personal philosophy (Ahnström et al., 2009; Burton, 2004a; Fish et al., 2003; Gasson, 1973; Harrison et al., 1998; Schoon and Grotenhuis, 2000; Siebert et al., 2006; Stock, 2007). But motivation is not a static component. Farmers' decisions about AES participation can be subject to a wide range of motivations active over different time frames, as shown in figure 6.1.

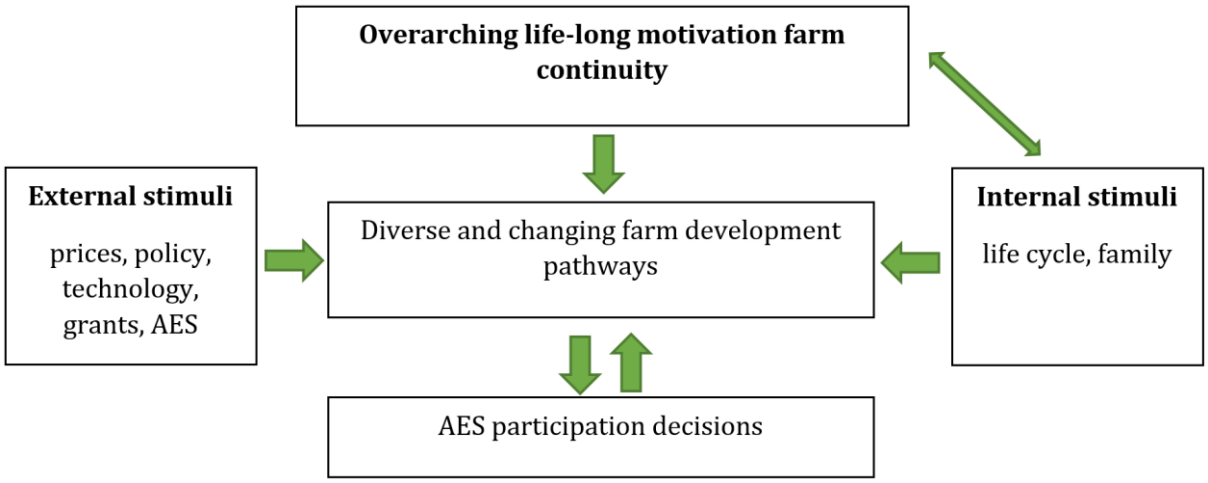

Figure 6.1 The wide range of motivations in farmers' decision making

As shown in figure 6.1, farmers are motivated by both internal and external stimuli. Internal stimuli offer opportunities for intrinsic motivation, whether external stimuli can provide for external motivation (Deci, 2008):

Intrinsic motivation: Based in the inherent satisfactions of the behaviour *per se* - is generally perceived as more autonomous and self-determined than extrinsic motivation. People also value intrinsic contents more than extrinsic contents.

Extrinsic motivation: Focused towards and dependent on contingent outcomes that are separable from the action *per se*.

6.2 Behaviour changing techniques in the CAP

Behaviour changing techniques can be used to trigger motivation. Except from the three categories from Young (1993) – information, positive motivational and coercive techniques – three additional guidelines were found in literature and during interviews that may help to increase motivation for a farmer to take more environmental measures. Hereafter, these techniques and guidelines will be introduced, supplemented by perspectives on how these are integrated in the new CAP.

6.2.1 Information techniques

These techniques rely on self-discovery, based on the idea that once people understand why and how to change their behaviour, they will get on with the task. The approach is especially effective for people who are ready to act but are uncertain as to which behaviour to adopt or on how to proceed. Practical examples of the technique is the use of educational tools, such as books, magazines and training programs as well as undergoing a deep personal change or experience,

for example through field exercises and participating in pilot projects (Young, 1993; Gray, 1985; Fazio and Zanna, 1981).

Currently, pillar 1 of the CAP does not offer opportunities for information techniques. On the contrary, some stakeholders stress it is especially difficult to find any information at all about the content and application of greening measures.

> NAJK: *"A major part of farmers' resistance to greening measures is caused by the various ambiguities in the application of these measures. Even the state advisory service (RVO) cannot answer all our questions."*

Pillar 2 offers some possibilities for information techniques, through offering subsidy for knowledge transfer and education initiatives.

6.2.2 Positive motivational techniques

Represented by this category are interventions using extrinsic motivation to make a behaviour more appealing or provide social support for those choosing the behaviour. The extrinsic motivation is usually represented by a reward, in the form of monetary reinforcement (subsidies, resources, etc.) and social reinforcement (social recognition, social support). Commonly used techniques use "block leaders", or rely on commitment, altruism or intrinsic satisfactions (Lokhorst, 2009; Young, 1993).

Greening measures in pillar 1 of the CAP can be considered as an example of a positive motivational technique; rewarding greening initiatives with monetary rewards. Farmers do not seem to be constrained, since they can choose to perform greening measures and receive income support, or not participate in the greening measures and not receive support. However, we must take into consideration that many farmers are financially dependent on income support. For starch potato growers, for example, income support represents over 30 percent of their total income (Bont et al., 2007) Furthermore, income support has been a part of a farmers' income for since World War II. From this perspective, the greening measures are an example of coercive motivational techniques and will be further discussed in the next paragraph.

Pillar 2 offers positive motivational techniques in the form of monetary awards. Depending on the nature of the measure, it can act as a 'platform' for initiatives which include other types of positive motivations, such as commitment or social reinforcement.

6.2.3 Coercive motivational techniques

When positive motivation is not effective, coercive techniques can change behaviour by constraining one's choice physically or perceptually. Some techniques do not use direct

punishment, for example when using monetary disincentives, social disincentives and the use of physical barriers to non-conserving behaviour. Other techniques use fear and doom scenario's, an example is the "frightening" method which has often been used to alert the community on climate change.

As discussed in 6.2.2, the monetary awards from pillar 1 can be considered as an example of a coercive motivational technique. The greening measures constrain one's choice physically or perceptually; "if you don't comply with greening measures, we will withhold your salary". The subsidy from pillar 1 is no longer an 'extra income'. Farmers feel like they are entitled to the monetary awards from pillar 1, and have also become dependent on it for their livelihood. At the same time, societal support for the use of 'tax money' as reward for farmers in pillar 1 is declining.

> Ministry of Economic affairs: *"By many stakeholders in agriculture, the CAP's income support of pillar 1 is considered to be a fund which farmers are entitled to. However, societal support for this status is decreasing."*

In pillar 2, coercive techniques are not an issue. Only when agreements are not met, legal consequences will follow.

6.2.4 Common marketing strategies

Sustainable farming, especially when applied trough a cycle approach as proposed in chapter 5, is a relatively new approach. It is necessary to inform farmers on the context, reduce the threshold and actively trigger farmers to participate. Environmental schemes such as pillar 2 of the CAP are relatively unknown by many farmers and stakeholders. This conclusion based on the experience with interviews; many farmers and stakeholders needed explanation about the content, opportunities and goals of pillar 2. Marketing strategies differ from information techniques because information – in contrast to marketing – has no intention of increase participation in certain behaviour. Marketing applies promotion, advertisement and publicity to trigger target groups.

6.2.5 Increasing freedom of choice

Within policy schemes is expected to increase motivation for changing behaviour. A study by Patal et al. (2009) stated that when individuals are allowed to affirm their sense of autonomy through choice, they experience enhanced motivation, persistence, performance and production. Of course, depending on the situation, too much freedom of choice is perceived as overwhelming and exhausting and may diminish the positive effect of choice on motivation. Also, it is important that there is no pressure on picking a specific choice and that all choices are approximately

equally attractive. Stakeholders and farmers supported this theory, confirming that choice is a critical component of the decision whether a farmer chooses to participate in an environmental scheme.

In pillar 1 farmers feel there is lack of freedom of choice. They would like to see that the CAP adopts a more broad view on environmental sustainability in the future, and gives more space to personal ambitions and a farm – or region customized approach.

> Farmers of southeast Brabant: *"Pillar 1 of the CAP has only few options and offers little freedom of choice. We would highly recommend to add more flexibility in the policy structure."*
>
> *ANOG: "More freedom of choice in the CAP would increase its effectivity, since substantial greening requires a customized approach; all farmers and their farms are different from each other."*
>
> Tholen: *"Freedom of entrepreneurship is highly valued among farmers. We feel we know our farm best and are able to make the right choices in order to make it more sustainable. Unfortunately, laws and regulations offer little freedom of choice in this matter, which is demotivating farmers to actively 'green' their farms."*

Pillar 2 offers more freedom of choice; farmers who have used POP2 funds are generally content about the possibilities and many stakeholders appreciate the liberty offered by the POP concept to design projects which fit the needs of a specific region. A liberty that is not offered by pillar 1.

6.2.6 The initiating actor of change

Initiating the farmers' behaviour change is of viable importance for its impact. Various types of stakeholders wish to achieve a change, but not all these stakeholders are equally successful in actually doing so. In general, companies who are committed to increasing farmers' living standards have the most influence on farmers' behaviour.

> Boerenbond Deurne: *"As agricultural advisors, we have a large impact on the choices made by farmers. They put great trust in the accuracy of our advice."*
>
> ZLTO: *"Farmers are more susceptible to requests from chain actor stakeholders than to government. This is originated in the relationship between those parties. In this context, I believe the government could choose for a different way of motivating farmers in favour of sustainability."*

> Waterboard of Vechtstromen: *"For the future, I expect that chain-agriculture relationships may become of more importance than the Brussels-agriculture relationship. However, guidance from both will remain necessary"*

Examples for the Netherlands are consultants (such as Boerenbond Deurne), special interest groups (such as NAJK), entrepreneurial and employers' organizations (such as LTO), food chain actors (such as Royal Cosun) and agricultural news – and opinion magazines. Farmers are not familiar with 'green' organisations (such as Greenpeace and the Dutch National Bird Protection Society) as well intentioned as their purposes may be. Therefore they need a lot more effort changing behaviour when compared to the farmer-committed companies mentioned before. The influence of government and green farmer organisations can be placed somewhere in between farmer-committed companies and 'green' organisations. Nowadays, the availability of social media should also be taken into consideration when trying to influence farmers. The CAP could offer opportunities for stakeholders to participate. This will be further discussed in chapter 7.

6.3 A variety in farmers and strategies

Now we have some insight in the techniques that are applicable in changing farmers' behaviour. But all farmers have different characters, interests and ideas. During the interviews with both stakeholders and farmers, often the concept of different 'types' of farmers was mentioned. In this study, farmers were divided in three clusters - the frontrunner, follower and critic - all requiring a different strategy for improving their environmental awareness and associated behaviour regarding sustainable farm management. Although these clusters were originally not based on scientific evidence, the theory did turn out to have similarities with findings from literature. For example, Barnes et al. (2010) showed three cluster types of farmers; multifunctionists (positive towards environmental and social facets of land use management), resistors (sceptical towards regulations and government interference) and apathists (lack of engagement in policies). Already in 1995, Morris and Potter proposed a spectrum of farmer types, from resistant non-adopters to active adopters.

6.3.1 The frontrunner

He is aware of sustainable solutions, has a high intrinsic motivation for applying (experimental) pro-environmental techniques and independently takes initiative in doing so. Usually, frontrunners only need information techniques to motivate them into pro-environmental behaviour. Monetary rewards can be detrimental and may have an adverse effect; behaviour that is rewarded runs the risk of losing its intrinsic motivation. Even when a behaviour was originally

initiated from an intrinsic motivation, people still tend to stop performing the behaviour when the reward is taken away (crowding out effect) (Frey, 1997; Deci et al., 1999).

6.3.2 The follower

Some might describe him as an opportunist. He is somewhat aware of sustainable solutions, might have some intrinsic motivation for applying pro-environmental techniques, is however critical towards arguments to apply those. He might apply certain techniques if other farmers do this as well. Often he is susceptible to social norms, his refusal to participate in environmental schemes might be expressed by statements like “a farmer is not a manager of the countryside” or “a farmer is a food producer” (Burton, 2004b; Zembla, 2015). A reward or certain (social) assurance might trigger followers to participate. These kinds of farmers need a combination of information and positive motivational techniques to motivate them into pro-environmental behaviour.

Combining information techniques with positive motivational techniques might be successful in changing followers’ behaviour. One example was the successful combination of information techniques with commitment making, as applied by Lokhorst (2009). There are several reasons how commitment making might work. The first theory is that people are generally motivated to behave in congruence with their self-concept and may thus alter their behaviour accordingly (Bem, 1972). The second theory is that commitment making might evoke a personal or social norm to this commitment (Kerr et al., 1977). The third theory is that making a commitment keeps the behaviour at hand salient and activates cognitive processes such as cognitive elaboration, resulting in a strong and central attitude towards the behaviour (Werner et al., 1995).

Others studies also stress the need for combining information techniques with positive motivational techniques. Ryan (2009) has found that the most important motivations for implementing best management practices in Western Washington were linked with personal motivational elements of personal stewardship ethic, accountability, personal commitment and feasibility. Direct personal contact was found to be the most effective information technique.

6.3.3 The critic

He is not or little aware of sustainable solutions, is very critical towards arguments to apply those. He usually very assertive and resolute in his opinion and it is very difficult to change his behaviour. A combination of information and positive motivational techniques might work for some of them to motivate them into pro-environmental behaviour. However, usually they will only change their management when coercive motivational techniques are applied (Barnes et al., 2010).

Especially governments frequently use coercive techniques. Rules and regulations are all examples of coercive techniques. One must follow the rules, or consequences will follow. In agriculture, these techniques are used frequently. Use of pesticides and fertilizer are probably subject to the largest share of the total amount of legislations and regulations. Environmental activists also use fear and doom scenarios are also used, especially in the past. These kinds of techniques are usually not effective for creating a long-term behaviour change. However, for the critics who are not perceptive to the above-mentioned techniques, it may be feasible as a last resort (Sidman, 1989; Young, 1993).

6.4 A new approach for the CAP's behaviour change strategy

In the previous paragraphs, it became clear that the current strategy for behaviour change in the CAP can be improved. Addition several types of farmers and relevant behaviour changing techniques were introduced. In table 6.1, an overview is given on which techniques are applicable for different farmer types.

Table 6.1 Overview of techniques and approaches which can be applied for different farmer types

	Information	**Positive motivation**	**Coercive techniques**	**Freedom of choice**	**Choosing an effective actor**
Frontrunner	x			x	x
Follower	x	x		x	x
Critic			x	x	x

Information techniques are applicable to a wide range of farmers. Positive motivation techniques offer opportunities to increase motivation for followers, either through monetary or non-monetary methods. This could be implemented by setting up study groups of farmers, providing those with information from an expert as well as the opportunity to be monetary rewarded to increase environmental sustainability on their farm. Naturally, it would not be honest not practical to not offer frontrunners and critics with the same opportunities. But the study groups could work; Frontrunners would probably apply more measures than are being monetary rewarded. Critics would probably not participate, and can be persuaded by other, coercive techniques to at least comply with legal standards. Followers' intrinsic motivation could increase, since the study group offers opportunities for positive motivation efforts, such as commitment making, social direct contact. Information could come from agricultural advisors and chain actors, which are generally trusted by farmers. Since participating in study groups and monetary rewarded projects is voluntary, freedom of choice is assured. Marketing can be applied by using advertisement for the study groups through various information media, trying to appeal a large quantity of farmers.

6.5 Conclusions

- The CAP needs to influence farmers' decision making, since agriculture is not just a biophysical system, but influenced by farmers' behaviour. Environmental-friendly measures need to become embedded in within farming cultures, through a shift in farmers' attitudes that will outlast the policy scheme themselves.
- Farmers' decision making is influence by various external and internal stimuli, resulting in intrinsic and extrinsic motivation. The former offers opportunities for inducing a long-lasting shift in farmers' attitude.
- Several information techniques are available to change farmers' behaviour, but the current CAP still poorly applies them.
- A new approach for the CAP's behaviour change strategy is proposed, taking into account the different types of farmers. Small study groups of farmers offer proficient opportunities for knowledge sharing and applying measures (whether monetary rewarded or not).

7 How the CAP's organisational structure can support environmental sustainability.

In the previous chapters, technical measures and behaviour change techniques have been discussed that can make the CAP more effective. In this chapter, recommendations are presented on how the organisational structure of the CAP can be reshaped to better support environmental sustainability. First, in 7.1, five recommendations are given for a more effective organisational structure in general. In 7.2 these recommendations are supported by a more visual description of different scenarios showing how the CAP's options could be reshaped.

7.1 Recommendations for a more effective CAP

7.1.1 Income support; blessing or a curse?

The farmers' community claims their strong position in the international trade in agricultural products and knowledge. However, the costs of production are relatively high in the EU when compared to other parts of the world. High land prices and requirements for basic farmer's income, food safety measures and transport are only a few elements causing a higher production price for agricultural products from the EU, compared to other countries. To keep production costs as low as possible, agriculture in the EU is continues intensifying, producing larger quantities while using less resources. These low prices recently lead to complaints and even some protest from French, German, Belgian and Dutch farmers (Boerderij, 2015a; Boerderij, 2015b).

In this study, participating farmers often expressed their preference for a sustainable income; ecologically and economically sound farming should go hand in hand. But in reality, they feel that the increasingly free market-oriented policies continue to squeeze farm prices and force them to cut costs, not taking into account the environmental costs (since it is difficult to express these in economic values). This observation has been pointed out by other studies as well, for example by Buck et al. (2008). The current market situation has led to a practice wherein not market revenues, but CAP subsidies are necessary to provide for a farmers' income (as shown in 6.2.2.), where resources are used in a non-sustainable way – and consequently will not be available for future generations - and we risk a prospect of farmers are being increasingly discouraged in their work.

Stakeholders and farmers also had an interesting theory on how CAP subsidies are actually increasing the trend of squeezing farm prices; the income support is received by every farmer, and thus every farmer has lower expenses, which results in farmers receiving less income for his product and paying more for farmlands (figure 7.1). If pillar 1 would not be maintained in the future, it is expected that market prices would adjust to the new production costs. Of course, these adaptations would need some time, since customers need to adapt to higher product prices. Pillar 2 of the CAP would then offer extra income for farmers, since it is a more differentiation and voluntary program, not providing for equal extra revenues for every farmer. The theory might be too straightforward to apply on the current situation. However, it is an interesting new approach to the effectiveness of pillar 1 funds for increasing market sustainability, especially since it is supported by various stakeholders and farmers.

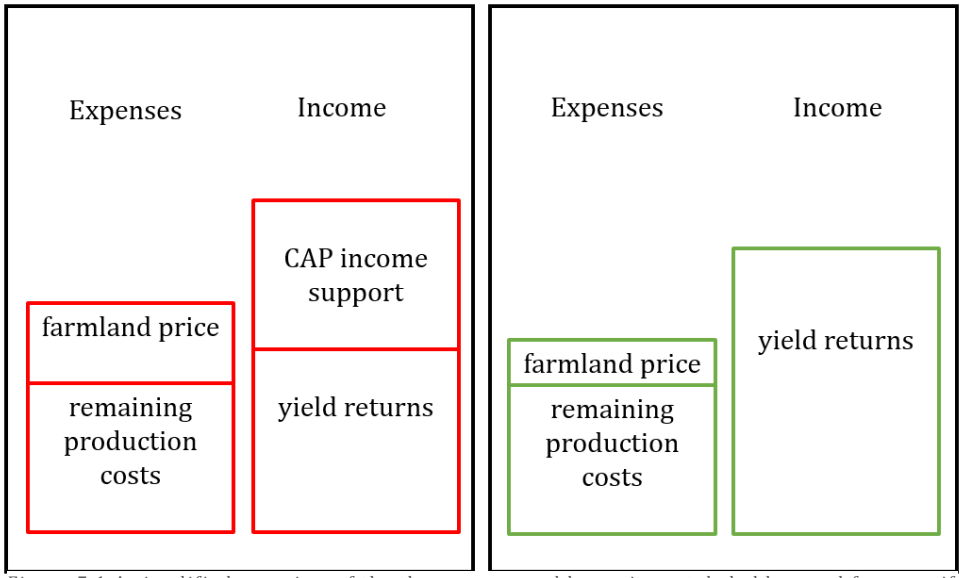

Figure 7.1 A simplified overview of the theory proposed by various stakeholders and farmers; if pillar 1 is maintained, market prices adapt and income support is decreasing yield returns (left). If pillar 1 would not be maintained (right), market prices are expect to adapt, with yield returns increasing and production costs (such as farmland price) would decrease, resulting in a more sustainable market situation.

There is a growing concern that the current market system is not sustainable, not healthy and not tenable in the future. We might need more influence from the government in this matter, since the market struggles and – so far – does not succeed in overcoming this issue. Conversion is only possible if the suppliers and customers are willing to come along, which has been proven to be a difficult process. Coercive motivation techniques, such as taxing unsustainable goods, and using subsidies to make sustainable products cheaper, might be a necessary solution. Especially if the ecological footprint is taken into consideration, since this would probably result in increased prices for imported products, which would stimulate the consumption of national (cheaper) products. The CAP would then become an instrument that solely functions for

increasing environmental sustainability, with focus on pillar 2. We could even consider not maintaining pillar 1, since market forces are regulated outside of the CAP.

7.1.2 Effective greening through a cycle-approach; allowing for farm-specific measures

According to the literature research in chapter 4, there are several environmental focus issues to be addressed in agriculture. The CAP currently does not address all issues in the Netherlands, especially soil and climate is undervalued. Most stakeholders feel that greening should apply to the whole of our natural environment, agreeing that the CAP should have a broader view on environmental sustainability. They proposed a cycle-approach in order to address greening more effectively, on the one hand because it takes the whole system into account and, on the other hand, because such a broad approach would be more attractive for farmers to actively participate in greening their farm. Farmers agree to this cycle-based system approach, and support the need for such an approach by identifying the environmental focus issues they encounter in their own region. As supported by chapter 6, a broader view on environmental sustainability might also have a positive effect on farmers' attitude towards sustainability, especially since it gives them more alternatives.

In practice, a broader view could be integrated in both pillar 1 and 2.

Pillar 1: Agro-environmental measures from table 5.3 that are easily verifiable for the government could form the new greening measures in pillar 1. The packages of equal measures, such as Skylark Foundation and Biodiversity+, existing in the current CAP, can be maintained, since they are a relevant source of experience for diversification of greening measures. The three greening measures might be maintained, for Member States that do not wish to develop a country-specific greening program. For the new CAP in the Netherlands, instead of three greening measures which are required for a particular selection of farmers, more farmers could be contributing in a more equivalent level if they could choose for measures which are applicable in their farm type (in contrast with the current situation, were arable farmers have to take more measures in comparison to other farmer types). Dutch farmers not participating in an organisation, such as the Skylark foundation, can choose from a list of measures. In practice, the following description could be applicable: For a farmer, a particular amount of income support is calculated, of which 30% is 'greening support'. In his annual agricultural inventory ('meitelling'), a farmer has to inform the government which greening measures he has applied. There is a list of available measures (as proposed in table 5.3), which are coupled to a certain value. A measure could equal 20% of the greening support, while another only represents 5%. A farmer can check the boxes for every greening measure he has taken on his farm. Figure 7.2 gives a simplified visualisation of what this would look like in the annual agricultural inventory.

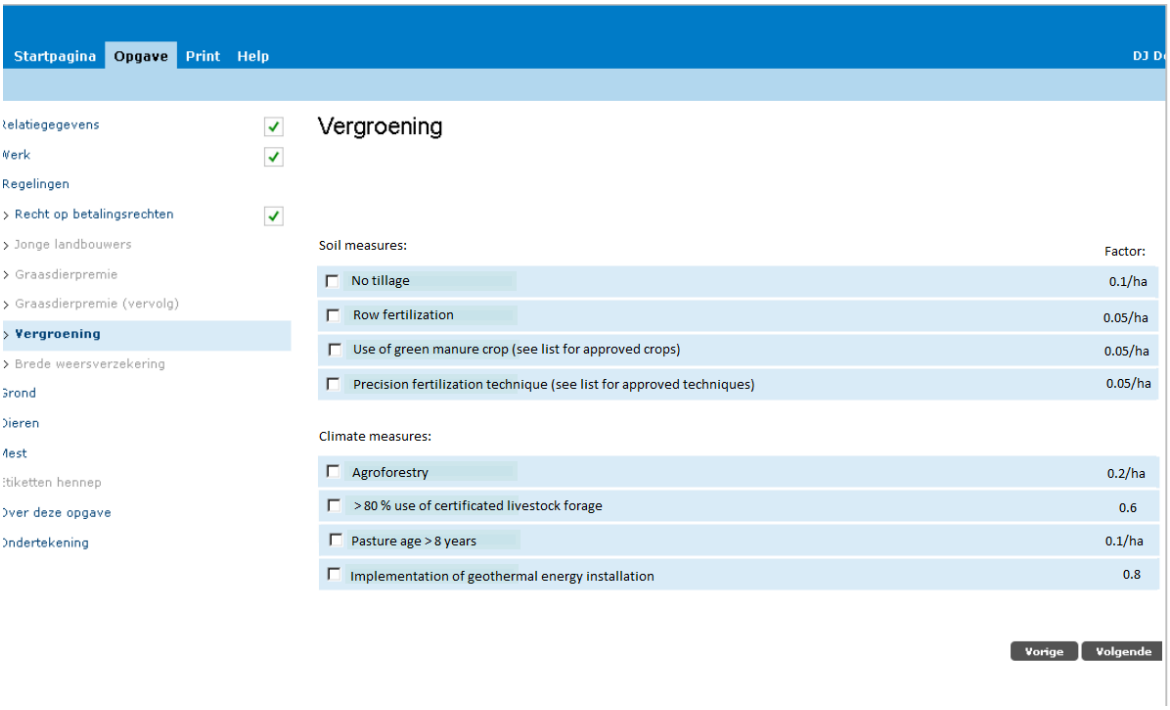

Figure 7.2 A simplified visualisation of how the new greening measures could be implemented in the CAP, and how this would look like in the annual agricultural inventory. Only soil and climate are shown, and a limited amount of measures, as an example. The factor is meant to calculate the value of a measure; when a farmer reaches 1.0, he will receive the whole greening fund.

Pillar 2: Pillar 2 could be integrated more into pillar 1. Addition agro-environmental measures can form the basis for initiatives in pillar 2, individually as well as in a group context. While pillar 1 offers more 'mainstream' measures, pillar 2 could be an instrument to stimulate innovations and pilots. The pillar 2 measures can be included in the annual agricultural inventory as well. Thus, the boundary between pillar 1 and 2 would be blurred, increasing the accessibility of pillar 2 for farmers. The different sources of funding (pillar 1 from EU, pillar 2 from co-funding) could be maintained, or the funds could be merged, as proposed in 7.1. Measures applied in a group context, could be initiated from bottom-up initiatives. Paragraph 7.2 will go into more detail regarding this approach.

7.1.3 Facilitate bottom-up initiatives

Pillar 2 could act as an instrument to facilitate bottom-up initiatives, which allow for region-specific projects, as proposed in paragraph 6.4. This approach would offer possibilities for applying behaviour changing techniques, through study groups. Additionally, for region-specific targets, it would offer possibilities for customized pilots and projects. The currently implemented regional collectives could support these groups. They could apply marketing strategies – as recommended in paragraph 6.2.4 – to inform farmers and persuade them to participate in pillar 2 programs. New farmers would be actively persuaded to join the study

groups, existing groups could join the collective as a whole. Stakeholders could find a connection with farmers through these collectives and study groups. The collectives can provide for information regarding environmental sustainable development, they could provide farmers with a easy assessable institution which is close by and where they drop their initiative and get support to pursue.

7.1.4 Aim at diversification, instead of McDonaldization

Farmers are discontent about the fact that the same greening measures are used for the whole of the EU. The EU has centralized agricultural policies into a general CAP policy to create a level playing field. However, it is argued that agriculture in the EU is too diverse for such a general CAP structure. This diversity is visible through biophysical and social differences, as well as in ambitions countries have for sustainability. Some countries take responsibility and proceed with measures for increasing sustainability in their national sector, whereas others need to be triggered by external factors (such as the EU). This CAP generalization is a process known as 'McDonaldization' and recognized to lead to disenchantment and decreased motivation among farmer participants, raising questions about the ability of these rationalized systems to deal with ecological variability and unpredictability, the marginalization of land manager knowledge and the de-skilling that it implies (Morris, 2007).

We have seen a decline in CAP budget in recent years, and it is expected to further decline in the upcoming years. Also, income support in pillar one is expected to be linked more with social services. The Netherlands get a return of about 50% of the total budget it contributes to the EU's CAP (Farm Europe, 2015). Combine this with the adverse impact of CAP generalization, and we may conclude we should choose for another approach. Instead of financially contributing to EU's generalizing greening requirements, which are not expected to have a significant effect for the Dutch environment, we could also use part of the current contribution to the EU for our national POP program for more effective measures. This would lead to a similar situation as in Sweden, were the government focus' lies on pillar 2 (4.8 billion euros for pillar 2, and 419 million euros for pillar 1).

7.1.5 Include all actors in the field

As described in paragraph 6.2.6, some actors can change farmers' behaviour more effectively than others. It was therefore recommended to offer opportunities for stakeholders to participate in CAP projects. Currently, there are only limited options for NGO's and companies to participate. Through the 'equivalent measures' of the Skylark foundation, companies have limited and indirect influence on greening measures. Through pillar 2, some stakeholders can offer services

to farmers in the form of knowledge transfer and education. Stakeholders might be interested in more participation options.

> CONO: *"As a company we may be interested in working together with a group of motivated farmers, in the context of CAP regulations. For example, we could support a regional collective in their initiatives."*

Including NGO's and market actors in the CAP regulations offers some opportunities:

- As described in paragraph 6.2.6, farmers are more susceptible to requests from chain actor stakeholders than from the government. Support for policies is usually limited, but agricultural advisors from 'inside' the chain are more likely to succeed in effectively induce a shift in attitude among farmers.
- The market has struggles becoming more sustainable. Power is concentrated in the hands of the end-users in the chain. Conversion is only possible if the suppliers and customers are willing to come along. For farmers, it is difficult to influence other actors in the chain. This is where the government can support, by setting up rules and legislations regarding sustainability and market prices (Smit, 2011). The CAP could offer a platform for the government to consult various stakeholders on specific regulations, and set up pilots to try innovative approaches such as short food supply chains.

To prevent the commercial market actors to become a dominant factor in the policy, this proposal could be set up with certain limitations. For example, only farmers and government can initiate a project in pillar 2. When a proposal is submitted, interested stakeholders can choose to support the project through monetary support and/or providing for information and a network. Also, stakeholders can participate through pillar 1 in the same way the Skylark Foundation is working together with actors such as Royal Cosun.

7.2 Different scenarios for reshaping of the CAP

The recommendations from 7.1 can be captured in a more visual display, showing how the CAP's structure could be shaped in order to implement the proposals from the previous paragraph. These proposals can be summarized in the following statement; in order for the CAP to become more effective for sustainable agriculture in the future, it must offer more opportunities for greening, it has to stimulate small-scale farmer initiatives, decrease its market support (this support would be filled in through more effective regulations), aim at differentiation and custom-made approaches instead of generalization, and try to include all actors in the food chain. Two scenarios are visualized, according to this new approach for the future CAP. The first being a slight adaptation to the existing CAP, the second contains more modifications.

7.2.1 Scenario 1

This scenario is an adaptation on the current scenario. Pillar 1 and 2 are maintained, but the suggestions from the previous chapter are implemented in the two pillars, as follows;

- More financial resources are being transferred from pillar 1 to 2. An extra top-up of pillar 2 funds is realized by adding governmental resources. It is recommended to allow stakeholders to and co-finance certain POP-programs. Additionally, they can offer information and training to farmers during POP projects.
- More equivalent programs are accepted as representing 'green by definition', since they allow for a broader view on greening options.
- There is a range of greening measures, which the farmer can choose from. In the annual agricultural inventory ('meitelling'), a farmer can check several boxes for several agro-environmental measures, as described in paragraph 7.1.2.
- Through pillar 2, the farmer can individually choose from an extended list of measures whether he desires to contribute more to sustainability, as well as participate in study groups. These measures are part of a broad spectrum of sustainability issues. The farmer is then offered assistance from his local collective to provide him with the necessary information.

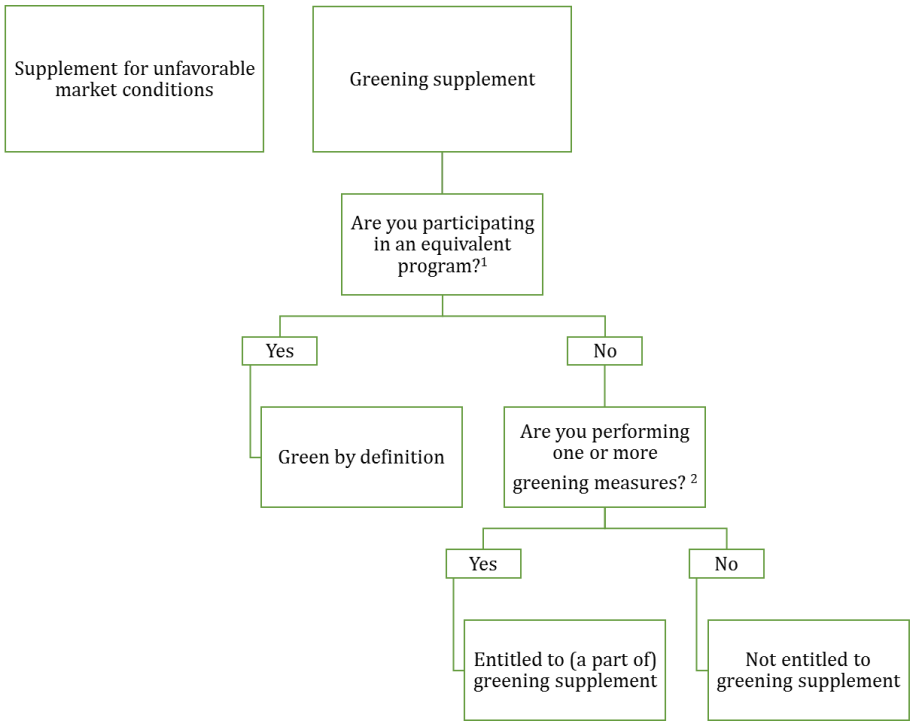

Figure 7.3 New pillar 1 structure in scenario 1

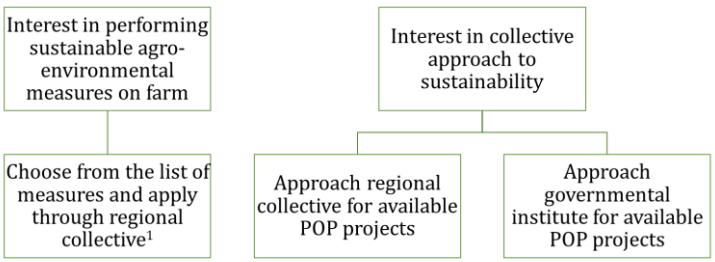

Figure 7.4 New pillar 2 structure in scenario 1

7.2.2 Scenario 2

In scenario 2, the assumption is made that the market insecurities, especially concerning competition issues with other countries, are solved through another regulation, as proposed in 7.1.1. The CAP now is only used to increase product sustainability. Scenario 2 is an extension of scenario 1. It contains more adaptations from the current scenario. The original pillar 2 is now responsible for making the agricultural sector more sustainable, supporting initiatives and projects with innovating and extra-legal nature. Funds have increased, because commercial companies and NGO's can participate in the CAP projects, supporting them with knowledge, leadership, training, marketing programs and financial resources. Now, the CAP acts as a platform, connecting all stakeholders in the field to actively make agriculture in the Netherlands more sustainable.

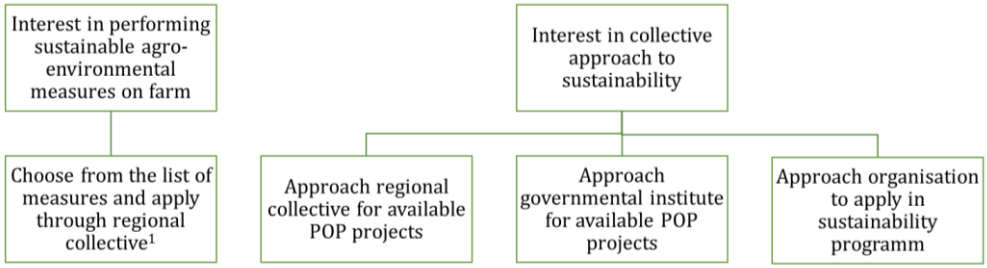

Figure 7.5 The CAP of scenario 2, with pillar 2 now being the dominant part of the policy.

8 Conclusions

In this chapter, first the sub-questions and main research questions will be answered in 8.1. This is followed by a review of the study, pointing out strengths and weaknesses and evaluating its possible role for the CAP in the future.

8.1 Conclusions on sub-questions and main research questions

8.1.1 Sub-questions

1. What is the role of the CAP in the past and present, how is it structured and what is its expected environmental impact? *(Chapter 3)*

The CAP was originally established to improve agricultural productivity, while enabling farmers to generate a reasonable income. However, it has transformed into a policy aiming to balance economic profits with environmental and societal benefits. In the Netherlands, pillar 1 is funded with a higher budget than pillar 2, however pillar 2 has a more voluntary nature and offers more freedom of choice to Member States and participating farmers. The CAP could be a promising instrument to address the EU's goals for climate, biodiversity and water quality. However, pillar 1 of the current CAP is not expected to have a significant impact on the environment. The permanent pastures regulation might even have a negative impact on grassland quality, especially regarding biodiversity and climate. Pillar 2 offers more opportunities, since it has been a promising approach in the previous CAP (POP2).

2. What are the recent trends in the interaction between agriculture, environment and society? *(Chapter 4)*

Agriculture has a strong relation with our natural environment. It depends on ecosystem services but natural ecosystems are affected by agroecosystems as well. After WWII, intensification and industrialisation of agriculture has led to exhaustion of our natural ecosystems. This has far-reaching consequences, for the ecosystem functioning, resource availability, agriculture continuation and human welfare.

3. Which environmental focus issues need to be addressed by agriculture? *(Chapter 4)*

Literature provides strong support that we need to address the following issues in order for agriculture to remain a reliable source of high quality and healthy food in the future: Soil (soil erosion, soil compaction, organic matter, availability of nutrients and artificial fertilizer use), landscape, nature and biodiversity, climate and air, and water (quality and quantity).

4. How can the CAP address greening, according to stakeholders, farmers and literature? *(Chapter 5)*

All stakeholders agree that agriculture needs to become more sustainable. Greening was perceived by all stakeholders as representing environmental sustainability. There is still a variety in perspectives on how greening can be implemented on farm level. A categorization can be made in stakeholders aiming at climate, biodiversity, water, soil or a combination of various issues. Although some argue that we need to focus on one element; most stakeholders feel we need to target the 'whole package' of environmental issues through a cycle-approach. Farmers agree on the need for a broad view on greening and application of a cycle-approach. The cycle based approach as proposed by Hees et al., (2009) offers a promising example. Farmers feel motivated to use the cycle approach in their farm, especially since it offers the possibility for a customized approach for greening, which can be filled in according the ambitions of farmers and suitability for farming practices.

5. How can the CAP affect farmers' decision making in favour of sustainability? *(Chapter 6)*

So far, little efforts are generated through the CAP to induce effectively a shift in farmers' attitudes towards environmental sustainability. AE measures need to become embedded within current farm management. There are three types of farmers: frontrunners, followers and critics, which are susceptible to different behaviour changing techniques. Currently, the CAP to effectively initiate behaviour change in farmers does not apply these techniques. The most promising approach for behaviour change is offered by the implementation of (existing) study groups onto a greater 'platform' were motivation techniques can be organized throughout regional collectives, in cooperation with stakeholders;

- Information can be presented to farmers in the study groups, for example by external stakeholders. This would be sufficient for frontrunners to apply new measures in their farm.
- Positive motivational techniques can be applied, for example through personal contact with consultants and other farmers, committing to certain goals within the study group and change of social norms (frontrunners may 'give a good example'). This would motivate followers to apply measures as well.
- Critics may be too difficult to persuade into greening their farm. They would probably not participate in study groups. Coercive techniques can be applied as a last resort, through agricultural rules and regulations.
- Common marketing strategies could persuade farmers into joining the study groups
- Increased freedom of choice would motivate farmers to actively participate in greening.

- It is important which stakeholder is the initiating actor of change. Special interest groups, entrepreneurial and employers' organizations, food chain actors, consultants and agricultural news – and opinion magazines usually have more impact than the government.

6. How can the CAP's organisational structure support environmental sustainability? *(Chapter 7)*

The CAP's organisational structure be reshaped in order to support the implementation of effective agro-environmental measures and behaviour change techniques. Five recommendations are defined for a more effective CAP structure:

1. Anticipate on the changing role of the CAP: The current market situation is neither sustainable nor tenable in the future. There is a limit on intensification and the squeezing of market prices. Various stakeholders and farmers state that the income support of the CAP is further increasing this effect, by increasing land prices and lowering revenues per unity product. Conversion is only possible if suppliers and customers are willing to come along. Since the market still has struggles in achieving this, it is proposed the government intervenes in this situation. Not through (CAP) subsidies, but through external regulations. One example of how these costs is by implementing taxes for unsustainable products,, at the supermarket level.
2. More effective greening with farm-specific measures: In order to address all environmental focus issues, the CAP needs to support more alternatives for region – and farm specific measures. Not only would a broader CAP target greening through effective more measures, it would also increase farmers' motivation for greening in general. Additionally, it would offer possibilities for a wider range of farmers to participate in greening (not mainly arable farmers, which is the current situation).
3. Facilitate bottom-up initiatives: Implementing voluntary study groups into a greater platform, applying more motivational techniques to increase the effectiveness would increase farmers' motivation to actively participate in greening. Information techniques would motivate the frontrunners. Positive motivational techniques, such as subsidized pilots and projects, social control and commitment would increase motivation in followers. Marketing strategies would actively persuade farmers into greening their farm. Various existing groups could participate as well. Regional collectives could act as an 'umbrella' institute for these study groups.
4. Diversification instead of McDonaldization: Generalizing (pillar 1 of the) CAP might be cost-effective for governments, but has negative effect on the CAPs effectivity. It is a process leading to disenchantment and decreased motivation among farmer

participants and raising questions about the ability of these rationalized systems to deal with ecological variability and unpredictability, the marginalization of land manager knowledge and the de-skilling that it implies. McDonaldization of the CAP adversely affects its impact on environmental sustainability. The budget for pillar 1 is also expected to decline, with further (cost effective) generalization being the expected result. At the same time, the Netherlands contributes more to the generalized pillar 1, than it receives from the EU. Combining all these trend, we may want to choose for a different path in the future CAP. Similar to Sweden, the Netherlands could decrease our pillar 1 contribution and available budget, and focus our national funds on pillar 2, which allows for diversification and effective greening.

5. Include all actors in the field: Allowing for stakeholders to participate in CAP financed projects would increase farmers' motivation for greening, since farmers are more susceptible to requests from chain actors than from governments. Stakeholders and NGO's usually have much expertise on specific farm management. A platform were farmers, stakeholders and government work together is a promising approach to increase environmental sustainability. Such an approach could affect the whole food chain, instead of its agriculture part.

7. How can the CAP be reshaped in the future, to increase its effectiveness for a more sustainable agricultural sector? *(Chapter 7)*

Two scenarios are proposed on how the CAP could be reshaped in order to become more effective for sustainability. Scenario 1 is a slight adaptation of the current situation. More financial resources are transferred to pillar 2 and stakeholders can co-finance pillar 2 projects as well. The available greening measures are increased, and more equivalent packages are accepted as being 'green by definition'. While pillar 1 offers a list of 'mainstream' greening measures, pillar 2 initiates subsidized projects with multiple farmers and offers extra subsidies for innovative measures and pilots. In scenario 2, pillar 1 in its current form is not maintained. Instead, every Member State has a customized POP program. It now solely functions as instrument for a more environmental sustainable agriculture. Market regulation is regulated through other instruments, for example by a tax system as proposed in 7.1.1.

8.1.2 Main research questions:

1. What is the effectiveness of the CAP for a more sustainable agricultural sector?

The study has focused on environmental sustainability (i.e. greening). For the environmental component of sustainability, the CAP is not yet expected to have a significant impact. The change

of its role does however allow farmers to slowly adjust to a new approach on farming. The effectiveness of the CAP seems to be especially hampered by its own internal contradiction between influencing market forces and increasing sustainability. These two elements are difficult to combine in one policy, because intensification and environmental sustainability are per definition contradicting trends. The McDonaldization of the CAP and its declining budget are considered to be the other two main obstructing elements for an efficient CAP. These elements decrease opportunities for innovation, do not stimulate the implementing of region – and farm specific measures and not actively motivate farmers for greening. There is an interesting theory, showing how income support actually increases the problem of intensification and price squeezing. We should therefore be critical not only towards the effect of the CAP for environmental sustainability, but social and economic sustainability as well.

2. How can the CAP become a more effective instrument for a more sustainable agricultural sector in the future?

This study proposes a reshaping of the CAP to increase its effectiveness for environmental sustainability. To increase effectiveness for environmental issues, a more diverse range of greening measures should be available to farmers. A cycle-based approach to greening would be more effective for the environment and increase farmers' motivation to participate. Region – and farm specific measures are more effective than generalized measures. Also, the effect of income support for social and economic sustainability is questionable. Therefore, this study proposes that the Netherlands focus on a national implementation of the CAP, preferably through focusing on (a renewed version of) pillar 2. Markets should be regulated by regulations outside of the CAP. In this new CAP, bottom-up initiatives can be supported by regional collectives and stakeholders. The CAP should become a platform for a food-chain approach, allowing various stakeholders to work together, and actively motivating and persuading participating actors to become more environmental sustainable.

8.2 Discussion

This study offers a strategy on increasing agricultural sustainability through reshaping of the CAP. Its shows how essential it is for agriculture to become more sustainable, in favour of food security. This is a conclusion supported by many. However, it is still difficult to target environmental issues in agriculture and through the CAP. It acts 'slow' to environmental problems. Its process is slowed down by negotiation, and compromises made between all different stakeholders often do not have substantial effect on sustainability, since the original measure has crumbled in the negotiation. This study does not take into account this 'field of forces', which is shaping the CAP. Instead, it simply shows an ideal CAP, a 'ideal image' we should

be working towards. It proposes to decrease the influence of this field, by focusing on a more national program. This might be a simplistic view, but might however be achievable (after all, other countries apply a similar approach).

Several stakeholders might not positively receive the proposal to abolish pillar 1. However, they should take into consideration that this proposal is made not by the author, but by farmers and stakeholders, the people who are considered to benefit from income support.

This study is unique in combining the perspectives of a broad range of stakeholders into one proposal. This also has its limitations. An interview is susceptible to bias; the representative might not represent the opinion of his company, the farmers can not represent every single opinion of all Dutch farmers, a resource person is subjected to present socially desirable answers, etc.

It is remarkable how – in the general discussion around the CAPs effectivity – the need for effective behaviour change has not – or to a limited extend – been referred to. This study sheds a light on the CAP's effectiveness, and shows that effective techniques are barely applied. This insight, as well as the recommendations on how to achieve behaviour change, offers promising opportunities for the CAP of the future. Technology and organisation are not sufficient for achieving change, a behaviour change is essential to this regard.

Literature

Ahnström, J., Höckert, J., Bergeå, H.L., Francis, C.A., Skelton, P., Hellgren, L. (2009). Farmers and nature conservation: what is known about attitudes, context factors and actions affecting conservation? Renewable Agriculture and Food 24, 38–47

Antle, J.M., Capalbo, S.M. (2002). Agriculture as a managed ecosystem: Policy Implications. Journal of Agricultural and Resource Economics 27(1), 1-15.

Agriconnect (2015). Gebruik van aanvulgrond zonder veen. Online <http://agriconnect.nl/thema/gebruik-van-aanvulgrond-zonder-veen>

Agriconnect (2015). Natuurlijke plaagbestrijding. Online <http://agriconnect.nl/thema/51-natuurlijke-plaagbestrijding>

Banwart, S. (2011). Save our oils. Nature 474, 151-152.

Barnes, A.P., Willock, J., Toma, L., Hall, C. (2010). Utilising a farmer typology to understand farmer behaviour towards water quality management: Nitrate Vulnerable Zones in Scotland. Journal of Environmental Planning and Management 54(4), 477-494.

Beketov, M.A., Kefford, B.J., Schäfer, R.B., Liess, M. (2013). Pesticides reduce regional biodiversity of stream invertibrates. Proceedings of the National Academy of Sciences of the United States of America 110(27), 11039-11043.

Bem, D. (1972). Self-perception theory. In L. Berkowitz (Ed.), Advances in experimental social psychology. San Diego, CA: Academic Press.

Benard, M., Cock Buning, T. de (2013). Exploring the potential of dutch pig farmers and urban-citizens to learn through frame reflection. Journal of Agricultural Environmental Ethics 26, 1015-1036.

Belder, E., Korevaar, H, Schaap, B. (2014). Evaluatie van gewassen als mogelijke equivalente maatregel voor ecologische aandachtsgebieden in het nieuwe GLB.

Biggs, R., Schlüter, M. (2015). Principles for building resilience: sustaining ecosystem services in social-ecological systems. Cambridge University Press.

Bindi, M., Olesen, J.E. (2011). The responses of agriculture in Europe to climate change. Regional Environmental Change 11(1), 151-158.

Blok, J. De, Helsen, H., Nouwens, F., Linden, A. van der (2009). Bevorderen van natuurlijke vijanden in de boomkwekerij. Praktijkonderzoek Plant en Omgeving, Wageningen.

Boerderij (2015a). Duitse boeren de straat op om lage prijzen. Online < http://www.boerderij.nl/Home/Nieuws/2015/8/Duitse-boeren-de-straat-op-om-lage-prijzen-2672239W/?intcmp=related-content

Boerderij (2015b). Boerenacties in België en Frankrijk. Online <http://www.boerderij.nl/Home/Nieuws/2015/8/Duitse-boeren-de-straat-op-om-lage-prijzen-2672239W/?intcmp=related-content>

Boerderij (2015c). Kamp ziet kansen voor groen gas in verduurzamen gasgebruik. Online <http://www.boerderij.nl/Home/Nieuws/2015/4/Kamp-ziet-kansen-voor-groen-gas-in-verduurzamen-gasgebruik-1741148W/>

Boerderij (2015d). Boeren kunnen zich wapenen tegen droogte. Online <http://www.boerderij.nl/Akkerbouw/Nieuws/2015/7/Boeren-kunnen-zich-wapenen-tegen-droogte-2660374W/>

Bont, C.J.A.M., Blokland, P.W., Prins, H., Roza, P., Smit, A.B. (2007). Zetmeelaardappelen en herziening van het EU-beleid. LEI, Den Haag.

Bos, M.M., Musters, C.J.M., Snoo, G.R. de (2014). De effectiviteit van akkerranden in het vervullen van maatschappelijke diensten. CML rapport 188.

Buck, A.J., de, Rijn, I. Van, Roling, N.G., Wossink, G.A.A. (2008). Farmers' reason for changing or not changing to more sustainable practices: An exploratory stury of arable farming in the Netherlands. The Journal of Agricultural Education and Extension 7(3). 153-166.

Burton, R.J.F. (2004a). Reconceptualising the behavioural approach in agricultural studies: a socio-psychological perspective. Journal of Rural Studies 20, 359–371.

Burton, R.J.F. (2004b). Seeing through the 'good farmers's eyes: towards developing an understanding of the social symbolic value of 'productivist' behaviour.

Burton, R.J.F., Paragahawewa, U.H. (2011). Creating culturally sustainable agri-environmental schemes. Journal of Rural Studies 27, 95-104.

Chappell, M.J., Lavalle, L.A. (2011). Food security and biodiversity: can we have both? Agriculture and Human Values 28, 3-26.

Chemnitz, C., Weigelt, J. (2015). Soil Atlas 2015. Heinrich Böll Foundation and Institute for Advanced Sustainability Studies.

CLM, Alterra (2015). Gevolgen en oplossingen voor ondergrondverdichting vastgelegd in factsheets. Online < http://bodemacademie.nl/gevolgen-en-oplossingen-voor-ondergrondverdichting-vastgelegd-in-factsheets/>

Cole, C.V., Duxbury, J., Freney, J., Heinemeyer, O., Minami, K., Mosier, A., Paustian, K., Rosenberg, N., Sampson, N., Sauerbeck, D., Zhao, Q (1997). Global estimates of potential mitigation of greenhouse gas emissions by agriculture. Nutrient Cycling in Agroecosystems 49, 221-228.

Commissie Deskundigen Meststoffenweg (2015). Nut en risico's van covergisting. Syntheserapport. Wettelijke Onderzoekstaken Natuur & Milieu. Wot-techncal report 32.\

Compendium voor de Leefomgeving (2012). Belasting van het milieu door gewasbeschermingsmiddelen, 1998-2010.

Compendium voor de Leefomgeving (2013) Afzet van chemische gewasbeschermingsmiddelen in de land – en tuinbouw, 1985 – 2013.

Davis, J.L., Shaw, G. (2006). Impacts of eutrophication on the safety of drinking and recreational water. Water and Health II.

Deci, E.L. (2009). Handbook of Self-determination Research. Boydell & Brewer Ltd. ISBN: 1580461565.

Dickson, M.H., Fanelli, M. (2013). Geothermal energy; Utilization and technology. Rougledge.

Dochy, O. (2012). Broedvogels en overwinterende akkervogels op gewone perceelsranden en Experimentele trioranden in de West-Vlaamse polders. Studie in opdracht van het provinciebestuur van West-Vlaanderen in
het kader van het Interreg IVa-project 'SOLABIO'. Brugge.

Elgersma, A. (2015). New developments in the Netherlands: dairies reward grazing because of public perception. Independent scientist, Wageningen.

Elkington, J. (1994). Towards the sustainable corporation: win-win-win business strategies for sustainable development. California Management Review 36(2), 90-100.

European Commission (2011). Communication from the commission to the european parliament, the council, the economic and social committee and the commitee of the regions, Our life insurance, our natural capital: an EU biodiversity strategy to 2020. Brussels.

European Commission (2012). The Common Agricultural Policy, a story to be continued. Luxembourg Publications Office of the European Union.

European Commission (2013). CAP Reform – an explanation of the main elements. Memo.

European Commission (2014a). The EU explained: Agriculture. Luxembourg, Publications Office of the European Union.

European Commission (2014b). Europe 2020 targets. Online text consulted 07-01-2015 http://ec.europa.eu/europe2020/targets/eu-targets/index_en.htm

European Commission (2015). The Water Framework Directive (WFD) and the Floods Directive (FD): Actions towards the 'good status' of EU water and to reduce flood risks. Brussels.

European Environmental Agency (2010). EU 2010 Biodiversity Baseline. EEA, Copenhagen. ISBN: 978-92-9213-164-7.

European Environmental Bureau (n.d.). Air and agriculture, factsheet. Online < http://www.airclim.org/sites/default/files/documents/factsheets-on-air-in-eu.pdf>

European Union (2013). Overview of CAP Reform 2014-2020. Agricultural Policy Perspectives Brief 5.

European Parliament (2000). Water Directive Framework. Directive 2000/60/EC.

Farm Europe (2015). The CAP: The most cost-effective EU policy for finance ministers. Online < http://www.farm-europe.eu/travaux/the-cap-the-most-profitable-policy-for-eu-finance-ministers/>

Fazio, R.H., Zanna, M.P. (1981). Direct experience and attitude-behavior consistency. Advances in Experimental Social Psychology 14, 161-202.

Fish, R., Lobley, M., Winter, M. (2013). A license to produce? Farmer interpretations of the new food security agenda. Journal of Rural Studies 29, 40-49.

Fish, R., Seymour, S., Watkins, C. (2003). Conserving English landscapes: land managers and agri-environmental policy. Environment and Planning A 35(1), 19–41.

Frey, B.S., Oberholzer-Gee, F. (1997). The cost of price incentives: An empirical analysis of motivation crowding-out. American Economic Review 87 (4), 746-755.

Garnett. T. (2011). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? Food Policy, 36(1), 23–32.

Gasson, R. (1973). Goals and values of farmers. Journal of Agricultural Economics 24(3), 521–542

Geiger, F., Bengtsson, J., Berendse, F., Weisser, W.W., Emmerson, M., Morales, M.B., Ceryngier, P., Liira, J., Tscharntke, T., Winqvist, C., Eggers, S., Bommarco, R., Pärt, T., Bretagnolle, V., Plantegenest, M., Clement, L.W., Dennis, C., Palmer, C., Oñate, J.J., Guerrero, I., Hawro, V., Aavik, T., Thies, C., Flohre, A., Hänke, S., Fischer, C., Goedhart, P.W., Inchausti, P. (2010). Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. Basic and Applied Ecology 12(4), 386-387.

Gray, D.B. (1985). Ecological beliefs and behaviors: Assessment and change. West-port, CT: Greenwood.

Graham-Tomasi, T. (1991). Sustainability: Concepts and implications for agricultural research policy. In: Pardley, P.G., Roseboom, J., Anderson, J.R. (1991). Agricultural Research Policy, International Quantitative Perspectives. Cambridge University Press, Cambridge.

Groenblauwenetwerken (2015). Een voorziening voor infiltreren, bufferen en afvoeren. Online <http://www.groenblauwenetwerken.com/measures/bioswales/>

Haes, H.A.U. de, Voortman, R.L., Bastein, T., Bussink, D.W., Rougoor, C.W., Weijden, W.J. van der (2012). Schaarste van micronutriënten in bodem, voedsel en minerale voorraden. Rapport en advies aan de minister en staatssecretaris van Economische Zaken, Landbouw en Innovatie. Platform Landbouw, Innoatie & Samenleving.

Hahn, T., Scheermesser, M. (2006). Approaches to corporate sustainability among German companies. Corporate social responsibility and environmental management 13, 150-165.

Hajer, M. (1997). The politics of environmental discourse, ecological modernization and the policy process. Oxford University Press, New York.

Hardeman, E., Jochemsen, H. (2012). Are there ideological aspects to the modernization of agriculture? Journal of Agriculture and Environmental Ethics 25.

Hardeveld, H. van., Lee, M. van der, Strijker, J., Bokhoven, A. van, Jong, H. de (2014). Toekomstverkenning bodemdaling.

Harrison, C.M., Burgess, J., Clark, J. (1998). Discounted knowledge: farmers' and residents' understandings of nature conservation goals and policies. Journal of Environmental Management, 54 (4), 305–320.

Hoogheemraadschap de Stichtse Rijnlanden (2015). Het regelen van het Waterpeil. Online <http://www.hdsr.nl/werk/droge-voeten/functie-kunstwerken/>

Gliessman, S.R (2007). Agroecology, the ecology of sustainable food systems. Second Edition. Taylor & Francis Group, Boca Raton.

Hees, E.M., Otto, A.A.C., Schans, F.C. van der (2009). Van top-down naar bodem-up, review van kringlooplandbouw in de melkveehouderij. CLM Onderzoek en Advies BV, Culemborg, CLM 703 -2009.

Herwaarden, G.J., Koedoot, M. (2011). Visie op Landschapskwaliteit. Landschapsbeheer Nederland.

Natuurbericht (2014). Natuurorganisaties ontevreden over vergroening landbouw. Online published 26 july 2014 < http://www.natuurbericht.nl/?id=12661>

Hols, L.H.J. van, Merckx, R., Orshoven, J. van, Diels, J., Elsen, A. (2011). Bodemverdichting op landbouwgrond. Interreg project Bodembreed.

Hristov, A.N, Oh, J., Giallongo, F., Frederick, T.W., Harper, M.T., Weeks, H.L., Branco, A.F., Moate, P.J., Deighton, M.H., Williams, S.R.O., Kindermann, M., Duval, S. (2015). An inhibitor persistently decreased enteric methane emissions from dairy cows with no negative effect on milk production. PNAS online < http://www.pnas.org/content/early/2015/08/11/1504124112>.

Infomil (2009). Veehouderijen, herziene versie. InfoMil, Den Haag.

INRA (2008). Agriculture and biodiversity, benefiting from synergies. INRA multidisciplinary Scientific Assassment. Online document < http://inra.dam.front.en.pad.brainsonic.com/ressources/afile/234091-71f15-resource-expert-report-on-agriculture-and-biodiversity-4-pages.html>

Jeffery, S., Gardi, C., Jones, A., Montanarella, L., Marmo, L., Miko, L., Ritz, K., Peres, G., Rombke, J., Putten, W.H. van der (2010). European Atlas of Soil Biodiversity. European Commission, Publications Office of the European Union, Luxembourg.

Jones, R.J.A., Montanarella, L. (n.d.). Soil Erosion in Europe. Online document published by the European Commission < http://eusoils.jrc.ec.europa.eu/esdb_archive/pesera/pesera_cd/sect_h6.htm>

Keating, B.A., Carberry. P.S., Bindraban, P.S., Asseng, S., Meinke, H., Dixon, J. (2010). Eco-efficient agriculture: concepts, challenges, and opportunities. Crop Science 50, 109-119.

Kerr, N.L., Garst, J., Lewandowski, D.A., Harris, S.E. (1997). That still, small voice: Commitment to cooperate as an internalized vs. a social norm. Personality and Social Psychology Bulletin 23, 1300-1311.

Kibblewhite, M.G., Ritz, K., Swift, M.J. (2008). Soil health in agricultural systems. Philosophical transactions B 363(1492), 685-701.

Kristensen, P. (2003). EEA core set of indicators: Revised version April 2003. Technical report. European Environmental Agency, Copenhagen, Denmark.

Leeuwen, L. van (2012). De hanenbalken, zelfmoord op het platteland. Atlas Contact. ISBN: 9045025124.

Lew, S., Lew, M., Szarek, J., Mieszcynski, T. (2009). Effect of pesticides on soil and aquatic environmental microorganisms - a short review, Fresenius Environmental Bulletin 18, 1390-1395.

Lichtfouse, E., Navarrete, m., Debaeke, P., Souchère, V., Alberola, C. (2009). Sustainable agriculture. Springer Dordrecht Heidelberg London New York. ISBN: 978-481-2665-1.

Lokhorst, A.M. (2009). Using commitment to improve environmental quality. Social and Organisational Psychology, Faculty of Social and Behavioral Sciences, Leiden University.

Maatlat Duurzame Veehouderij (2014). Licht in de MDV. Online <http://www.maatlatduurzameveehouderij.nl/61/m/praktijkvoorbeeld/134/details.html>

Managementsite (2015). Kennisbank verandermanagement. Online document < https://www.managementsite.nl/kennisbank/verandermanagement>

Manhoudt, A.G.E., Snoo, G.R. de (2003). A quantitative survey of semi-natural habitats on Dutch arable farms. Agriculture Ecosystems and Environment 97, 235-240.

Meerburg, B.G., Korevaar, H., Haubenhofer, D.K., Blom-Zandstra, M., Keulen, H. van (2009). , Review: The changing role of agriculture in Dutch society. Journal of Agricultural Science 147, 511-521.

Melkvee (2015). Consortium ontwikkelt nieuwe emissiearme stallen. Online <http://www.melkvee.nl/nieuws/7473/consortium-ontwikkelt-nieuwe-emissiearme-stallen>

Millennium Ecosystem Assessment (2005). Ecosystems and human well-being: Synthesis. Island Press, Washington, DC.

Milieucentraal (2015). Soja en palmolie. Online <http://www.milieucentraal.nl/voeding/tropische-producten/soja-en-palmolie/>

Minnen, J. Van, Ligtvoet, W. (2012). Effecten van klimaatverandering in Nederland. Planbureau voor de Leefomgeving, Den Haag.

Morris, C., Potter, C. (1995). Recruiting the new conservationists: Farmers' adoption of agri-environmental schemes in the U.K. Journal of Rural Studies 11(1), 51-63.

Nederlands Centrum voor de Ontwikkeling van Rijenbemesting, 2015. Online <http://www.rijenbemesting.nl/page13.php>

Noorduyn, L. (2004). Stuwkracht, integrale gebiedsgerichte aanpak waterconservering Limburg en Noord-Brabant. Project Waterconservering 2e generatie. ZLTO Vereniging en Communicatie

Patal, E.A., Cooper, H, Robinson, J.C. (2008). The Effects of Choice on Intrinsic Motivation and Related Outcomes: a Meta-Analysis of Research Findings. Psychological Bulletin 134(2), 270-300.

Paustian, K., Elliott, E.T., Hunt, H.W. (2000). Management options for reducing CO2 emissions from agricultural soils. Biogeochemistry 48, 147-163.

PBL (2015). Samen werken aan schoon water levert voordelen voor landbouw, drinkwaterwinning en natuur. Online <http://themasites.pbl.nl/natuurlijk-kapitaal-nederland/nieuws/samen-werken-aan-schoon-water-levert-voordelen-voor-landbouw-drinkwaterwinning-en-natuur>

Peeters, 2014. De Blauwe kiekendief kan blijven dansen. Vogels 04-14, 17-21

Pendolovska, V., Fernandez, R., Gugele, B., Ritter, M. (2014). Annual European Union greenhouse gas inventory 1990-2012 and inventory report 2014. Technical Report No 09/2014. European Commission (DG Climate Action) and European Environment Agency, Brussels.

Pe'er, G., Dicks, L.V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T.G., Collins, S., Dieterich, M., Gregory, R.D., Hartig, F., Henle, K., Hobson, P.R., Kleijn, D., Neumann, R.K., Robijns, T., Schmidt, J., Shwartz, A., Sutherland, W.J., Turbé A., Wulf, F., Scott, A.V. (2014). EU agricultural refrm fails on biodiversity. Science 344(6188), 1090-1092.

Philips, R., Philips, S.H. (2015). No Tillage agriculture, principles and practices. Van Nostrand Reinhold Company inc.

Plieninger, T., Dijks, S., Oteros-Rozas, E., Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. Land Use Policy 33, 118-129.

Power, A.G. (2010). Ecosystem services and agriculture: tradeoffs and synergies. Philosophical transactions of the Royal Society B 365, 2959-2971.

Prasuhn, V. (2012). On-farm effects of tillage and crops on soil erosion measured over 10 years in Switzerland. Soil and Tillage Research

Rigueiro-Rodrígurez, A., McAdam, J., Mosquera-Losada, M. (2009). Agroforestry in Europe, current status and prospects. Volume 6. Springer Science and Business Media B.V.

Rijksoverheid (2015). Rijksbegroting 5.4 Europese geldstromen. Online <
http://www.rijksbegroting.nl/2015/voorbereiding/begroting,kst199407_21.html>

Roekel, A. van (2014). Oud zout rukt op. Kennislink online document <
http://www.kennislink.nl/publicaties/oud-zout-rukt-op>

Roelsma, J., Massop, H.T.L., Maaswaal, D., Wiegman, W. (2014). Het effect van landbouwkundig gebruik van een waterberging op de waterkwaliteit. Vakblad H2O online, september 2014.

Ryan, C.M. (2009). Managing Nonpoint Source Pollution in Western Washington: Landowner Learning Methods and Motivations. Environmental Management 43; 1122-1130.

Schmidt, M.W.I., Torn, M.S., Abiven, S., Dittmar, T., Guggenberg, g., Janssens, I.A., Kleber, M., Kögel-Knabner, I., Lehmann, J., Manning, D.A.C., Nannipieri, P., Rasse, D.P., Weiner, S., Trumbore, S.E. (2011). Persistence of soil organic matter as an ecosystem property. Perspective. Nature 478, 49-56.

Schoon, B., Grotenhuis, R te (2000). Values of farmers, sustainability and agricultural policy. Journal of Agricultural and Environmental Ethics 12(1), 17–27

Schrama, K.S. (2014). Georgica. Documentary broadcasted by NPO on 16-04-2015.

Sevenster, J. (2014). Europa geeft streek de groene ruimte. Mogelijkheden vergroening via directe betalingen nieuw GLB. Ministerie van Economische zaken, powerpoint presentatie. Online document < http://www.brabantslandschap.nl/assets/Uploads/Documenten/Presentatie-EZ-Jan-Sevenster.pdf>

Sheibani, S., Gholamalizadeh Ahangar, A. (2013). Effect of tillage on soil biodiversity. Journal of Novel Applied Sciences 2(8), 273-281.

Siebert, R., Toogood, M., Knierim, A. (2006). Factors affecting european farmers' participation in biodiversity policies Sociologia Ruralis, 46(4), 318–340.

Sidman, M. (1989). Coercion and its fallout. Authors Cooperative Inc., Boston, MA.

Silvis, H.J., Terluin, I.J., Jager, J.H. (2012). Plattelandsontwikkelingsprogramma 2007-2013. Samenvattend verslag 2012. LEI-nota 13-012, LEI Wageningen UR, Den Haag.

Smaling, E. (2012). Verbal statement during symposium of KNGMG on 16 march 2012 in Amsterdam. As reported online by Roekel, A. < http://www.kennislink.nl/publicaties/fosfaatmijnen-raken-leeg-tijd-voor-hergebruik>

Smit, A.A.H. (2011). Conversion to organic agriculture: opportunities and constraints. Proefschrift aan de Universiteit Utrecht.

Smith, V.H., Tilman, G.D., Nekola, J.C. (1999). Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. Environmental Pollution 100, 179-196.

Snoo, A. de (2015). Roep in Brussel om wijziging vergroening. Nieuwe Oogst, online news consulted 01-2015

Sollie, S., Brouwer, E., Kwaadsteniet, P. De (2011). Handreiking Natuurvriendelijke oevers, een standplaatsbenadering. STOWA, Amersfoort.

Spuitdoppenkeuze (2015). Advies over agrarische spuitdoppen. Online <http://spuitdoppenkeuze.nl/>

Sutton, M.A., Howard, C.M., Erisman, J.W., Billen, Gilles, Bleeker, A., Grennfelt, P., Grinsven, H. van, Grizzetti, B. (2011). The European Nitrogen Assessment. Cambridge University Press. ISBN 9781107006126.

Steenbruggen, A., Luske, B., Dirks, D., Erisman, J.W., Janmaat, L. (2015). De oogst van Bloeiend Bedrijf. Akkerranden voor natuurlijke plaagbeheersing. Louis Bolk Instituut.

Stoate C., Baldi A., Beja P., Boatman N. D., Herzon I., van Doorn A., de Snoo G. R., Rakosy L., Ramwell C. (2009). Ecological impacts of early 21st century agricultural change in Europe: a review. Journal of Environmental Management 91, 22–46

Stock, P.V. (2007). Good farmers' as reflexive producers: an examination of family organic

farmers in the US Midwest. Sociologia Ruralis 47(2), 83–103

Sukkel, W. (2014). Weerbare productiesystemen, van theorie naar parktijk. Praktijkonderzoek Plant & Omgeving. Wageningen.

Team Vier (2011). Biologisch Boerengeluk. Onderzoek uitgevoerd voor Wakker Dier.

Tscharntke, T., Gibbs, K.E., Mackey, R.L., Currie, D.J. (2009). Human land use, agriculture, pesticides and losses of imperilled species. Diversity and Distributions 15, 242-253.

Turnhout, E., Lijster, E. de (2015). Discoursanalyse ecosysteemdiensten. Wageningen Universiteit & CLM. CLM870-2015.

VBBM (2015). Innovatie; sleepslangsysteem. Online nieuwsbericht <http://www.devbbm.nl/VBBM-Actueel/>

Vermeulen, G.D., Verwijs, B.R., Akker, J.J.H. van den (2013). Vergelijking van de bodembelasting bij agrarisch veldwerk in 1980 en 2010. Plant Research International, WageningenUR, rapport 501.

Vewin (2015). Nederlandse waterkwaliteit nog niet in orde, vooral landbouw veroorzaker watervervuiling. Online news article < http://www.vewin.nl/nieuws/paginas/Nederlandse_waterkwaliteit_nog_niet_in_orde_vooral_landbouw_veroorzaker_watervervuiling_701.aspx>

Visser, A., Leendertse, P.C., Boer, D.J. den, Termorshuizen, A.J. (2008). Gereedschapskist voor biodiversiteit en landbouw. CLM Onderzoek en Advies BV en NMI.

Vlaanderen (2015). Informatiefiche subsidie verwarringstechniek in de fruitteelt. Departement Landbouw & Visserij. Online http://lv.vlaanderen.be/sites/default/files/attachments/fiche_21_huisstijl_subsidie_verwarringstechniek_in_de_fruitteelt_versie_20150319.pdf

Vliet, R.E., Dijk, J. Van, Wassen, M.J. (2015). Openheid en dichtheden van weidevogels, Landschap 1, 39-47.

Vogelbescherming Nederland, Landschapsbeheer Nederland, De 12 Landschappen, Natuur & Milieu, Natuurmonumenten, Milieudefensie (2014). Naar een écht groen Gemeenschappelijk Landbouwbeleid, Visie van de natuur – en milieuorganisaties op een echt groen GLB.

Werner, C.M., Turner, J., Shipman, K., Twitchell, S.F., Dickson, B.R., Bruschke, G.V., Bismarck, W.B. von (1995). Commitment, behavior, and attitude change: An analysis of voluntary recycling, Journal of Environmental Psychology 15, 197-208.

Westhoek, H., Zeijts, H. van, Witmer, M., Berg, M. van den, Overmars, K., Esch, S. van der, Bilt, W. van der (2012). PBL Note; Greening the CAP. PBL Netherlands Environmental Assessment Agency. Publication number 500136007.

Willer, H., Schaack, D. (2015). Organic Farming and Market Development in Europe. Europe: Current Statistics

Wilt, J., Schuiling, R.D. (2011). Fosfaat in balans. Urgentie en opties van onderzoek en beleid. Spil

271-274 (172), 31-36.

Wit, J. De, Wagenaar, J.-P. (2013). De waarde van agrobiodiversiteit, vijf maatregelen voor een beter gebruik. Louis Bolk Instituut.

Young, R. de (1993). Changing behavior and making it stick. The Conceptualization and Management of Conservation Behavior. Environment and Behavior 25(4), 485.

Zembla (2015). De topsporters van de melkindustrie, deel 2. Uitzending op VARA op 18 juni 1015.

Zhang, W., Ricketts, T.H., Kremen, C., Carney, K., Swinton, S.M. (2007). Ecosystem services and dis-services to agriculture. Ecological Economics 64, 253-260.

Appendix 1 Interview questions, standard form (Dutch)

1. Wat is uw functie binnen uw organisatie?
2. Op welke manier zet uw organisatie zich in voor een meer duurzame landbouw?
3. Op welke wijze heeft uw organisatie te maken met het GLB, en gaat dit dan om pijler 1, pijler 2 of beiden?
4. Wat is voor u de definitie van vergroening in de landbouw?
5. Vind u het goed dat vergroening nu gebonden is aan hectares, waardoor bepaalde sectoren – zoals intensieve veehouderij – er in toeslag op achteruit gaan?
6. Wat vind u van de vergroeningseisen zoals ze nu zijn geformuleerd?
7. In welke mate verwacht u dat het GLB zal bijdragen aan verduurzaming van de landbouw, wanneer u redeneert vanuit uw eigen definitie voor verduurzaming?
8. Zou het goed zijn om in de toekomst Pijler 1 te schrappen uit het GLB?
9. Wat vind u van het idee om in Pijler 1 alleen nog goedgekeurde pakketten te gebruiken in plaats van de drie vergroeningseisen?
10. Denkt u dat de collectieven in de toekomst – naast agrarisch natuurbeheer – ook een rol zouden moeten krijgen in het aanbieden van een breder pakket aan agro-milieumaatregelen?
11. Heeft u aanvullingen op de vergroeningseisen zoals ze nu zijn gedefinieerd?
12. Heeft u aanvullingen op POP3 zoals deze nu is opgezet?

Appendix 2 Interview questions chain actors (Dutch)

These were applied in the interviews with CONO and Suikerunie

Algemeen:

1. Wat is uw functie binnen uw organisatie?
2. Op welke manier zet uw organisatie zich in voor een meer duurzame landbouw?
3. Op welke wijze heeft uw organisatie te maken met het GLB, en gaat dit dan om pijler 1, pijler 2 of beiden?

-

- Duurzame landbouw:
  4. Wat zijn voor u de eisen waaraan een duurzame landbouwsector moet voldoen?
  5. Wat zijn de stappen die genomen moeten worden om tot een meer duurzame sector te komen?
  6. Hoe zouden de verschillende betrokken partijen een rol moeten spelen in het bereiken van bovenstaande?

GLB algemeen:

7. In welke mate verwacht u dat het GLB zal bijdragen aan verduurzaming van de landbouw, wanneer u redeneert vanuit uw eigen definitie voor verduurzaming?
8. Wat is voor u de definitie van vergroening in de landbouw? En eventueel; wat vind u van de vergroeningseisen in pijler 1?
9. Hoe zouden pijler 1 en 2 beter gekoppeld kunnen worden?

GLB pijler 1:

10. Vind u het goed dat vergroening nu gebonden is aan hectares, waardoor bepaalde sectoren – zoals intensieve veehouderij – er in toeslag op achteruit gaan?
11. Zou het goed zijn om in de toekomst Pijler 1 te schrappen uit het GLB?
12. Wat vind u van het idee om in Pijler 1 alleen nog goedgekeurde pakketten te gebruiken in plaats van de drie vergroeningseisen?

GLB pijler 2:

13. Denkt u dat de collectieven in de toekomst – naast agrarisch natuurbeheer – ook een rol zouden moeten krijgen in het aanbieden van een breder pakket aan agro-milieumaatregelen?
14. Biedt de huidige opzet van het nieuwe POP voldoende mogelijkheden voor een meer duurzame landbouw op alle mogelijke onderwerpen? (klimaat, biodiversiteit, water, bodem)
15. Is het nieuwe POP voldoende stimulerend wat betreft financiële prikkel?
16. Is het nieuwe POP voldoende stimulerend wat betreft imago en ‘outlook’?
17. Zijn er praktische problemen bij de toepassing van het nieuwe POP? Graag een aantal zaken benoemen.

Overig:

18. Heeft u verder nog aanvullingen op dit onderwerp of tips die voor mijn onderzoek van toegevoegde waarde zouden kunnen zijn?

Appendix 3 Interview questions (financial) suppliers (Dutch)

These were applied in the interviews with the Rabobank and Boerenbond Deurne

Algemeen:

1. Wat is uw functie binnen uw organisatie?
2. Op welke manier zet uw organisatie zich in voor een meer duurzame landbouw?
3. Op welke wijze heeft uw organisatie te maken met het GLB, en gaat dit dan om pijler 1, pijler 2 of beiden?

-

- Duurzame landbouw:

4. Wat zijn voor u de eisen waaraan een duurzame landbouwsector moet voldoen?
5. Wat zijn de stappen die genomen moeten worden om tot een meer duurzame sector te komen?
6. Hoe zouden de verschillende betrokken partijen een rol moeten spelen in het bereiken van bovenstaande?

GLB:

7. Wat is voor u de definitie van vergroening in de landbouw?
8. Vind u het goed dat vergroening nu gebonden is aan hectares, waardoor bepaalde sectoren – zoals intensieve veehouderij – er in toeslag op achteruit gaan?
9. Wat vind u van de vergroeningseisen zoals ze nu zijn geformuleerd?
10. In welke mate verwacht u dat het GLB zal bijdragen aan verduurzaming van de landbouw, wanneer u redeneert vanuit uw eigen definitie voor verduurzaming?
11. Zou het goed zijn om in de toekomst Pijler 1 te schrappen uit het GLB?
12. Wat vind u van het idee om in Pijler 1 alleen nog goedgekeurde pakketten te gebruiken in plaats van de drie vergroeningseisen?
13. Denkt u dat de collectieven in de toekomst – naast agrarisch natuurbeheer – ook een rol zouden moeten krijgen in het aanbieden van een breder pakket aan agro-milieumaatregelen?
14. Heeft u aanvullingen of aanpassingen voor het huidige GLB waardoor deze beter zou aansluiten bij uw visie op een duurzame landbouw en wellicht een beter hulpmiddel kan zijn voor uw organisatie? Dit kunnen zowel concrete agro-milieumaatregelen zijn als ook beleidstechnische of administratieve zaken.
15. Is het nieuwe POP voldoende stimulerend wat betreft financiële prikkel?
16. Is het nieuwe POP voldoende stimulerend wat betreft imago en ‘outlook’?
17. Zijn er praktische problemen bij de toepassing van het nieuwe POP? Graag een aantal zaken benoemen.

Overig:

18. Heeft u verder nog aanvullingen op dit onderwerp of tips die voor mijn onderzoek van toegevoegde waarde zouden kunnen zijn?