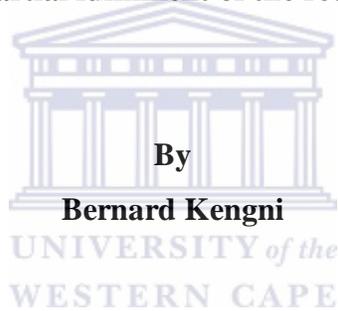


UNIVERSITY OF THE WESTERN CAPE

LAW FACULTY

**TRADE AND ENVIRONMENT: THE ENVIRONMENTAL IMPACTS OF THE
AGRICULTURAL SECTOR IN SOUTH AFRICA.**

Research paper submitted in partial fulfilment of the requirements for the LLM Degree



Student N° : 3002545

**Prepared under the Supervision of
Professor R Wandrag**

November 2012

DECLARATION

I hereby declare that this research paper is original and has never been presented in any other institution. I also declare that all the sources I have used or quoted have been indicated and acknowledged as complete references. It is in this regard that I declare this work as originally mine.

Student: Bernard Kengni

Signature: _____

Date: _____



DEDICATION

I dedicate this research to the memory of my late father Mr. TANTAN Felix who gave everything he could to see me embark on this journey but unfortunately passed away before I received my admission letter from the University of the Western Cape.

I equally dedicate this research to my mother Mrs. MENGUEL Madeleine whose continuous efforts have helped me to achieve successes in all my endeavours in the absence of my dad.

I am forever grateful to my parents for their support and sacrifice.

<<<<<<>>>>>>

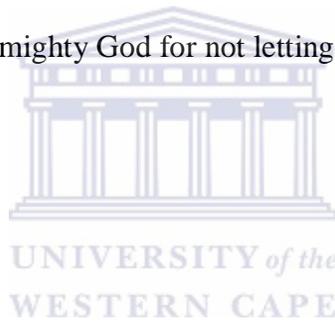


ACKNOWLEDGMENT

My gratitude goes to my supervisor, Prof R Wandrag, for her dedication and guidance in taking me through a challenging but exiting path of research and academic writing. It would have been impossible to complete this study without her untiring support. I am also grateful to Prof I Leeman for making my thesis more readable and comprehensible than would have been the case. He devoted his quality time to proofread the whole draft of my thesis.

I will like to thank my wonderful wife, Mrs. Vivette KENGNI, for her unceasing encouragement and support throughout the period I was involved in undertaking this study. I am also thankful to my family and friends, for being there for me whenever I needed them.

Above all I thank the Almighty God for not letting me walk this road alone.



KEYWORDS

Agreement on Agriculture

Agriculture

Climate Change

Environment

General Agreement on Tariff and Trade

Human Health

International Trade Law

Sanitary and Phytosanitary Measures

World Trade Organisation



LIST OF ABBREVIATIONS

WTO	World Trade Organisation
GATT	General Agreement on Tariffs and Trade
DDT	Dichlorodiphenyltrichloroethan
ITL	International Trade Law
AoA	Agreement on Agriculture
SPS	Sanitary and Phytosanitary Measures
DSB	Dispute Settlement Body
GDP	Gross Domestic Product
CIA	Central Intelligence Agency
NAFTA	North American Free Trade Area
EU	European Union
TBT	Technical Barriers to Trade
UNEP	United Nations Environmental Program
POP	Persistent Organic Pollutant
SADC	Southern African Development Community
RAP	Regional Agricultural Policy
GMO	Genetically Modified Organisms
NAAEC	North American Agreement for Environmental Corporation
CAP	Common Agricultural Policy
ECJ	European Court of Justice
GE	Genetic Engineering
FDA	Food and Drug Administration
GHG	Greenhouse Gas
CO ₂	Carbon Dioxide
CH ₄	Methane
US	United States
K	Potassium
Mg	Magnesium
NO ₃	Nitrate

Ca Calcium
SO₄ Sulphate



TABLE OF CONTENTS

	Pages
Declaration.....	I
Dedication.....	Ii
Acknowledgement.....	Iii
Keywords.....	Iv
List of Abbreviations.....	v
Table of Content.....	vii
1. Chapter One: Introduction.....	1
1.1 Background.....	1
1.2 Objectives and Research Question.....	2
1.3 Problem Statement.....	3
1.4 Scope of the Research.....	4
1.5 Significance of the Research.....	4
1.6 Research Methodology.....	5
1.7 Preliminary Structure.....	5
2. Chapter Two: Historical Background of the Laws Regulating the Impact of Agriculture on the Environment.....	7
2.1 Introduction.....	7
2.2 The Development of Environmental Protection Norms from the GATT to the WTO..	7
2.2.1 Environmental Concerns Deriving from Agricultural Practices Addressed Under the GATT 1947.....	8
2.2.2 The Evolution of Agricultural Related Norms Towards Environmental Safety Under the WTO.....	9
2.3 The South African Legal Approach Towards the Protection of the Environment Within the Agricultural Sector.....	11
2.3.1 South Africa's Acceptance of the Global, Regional and Sub-Regional Environmental Protection Norms Within the Agricultural Sector.....	12
	vii

2.3.2	Environmental Protection Afforded by South African Law.....	14
2.4	Agriculture and the Environment as Addressed by NAFTA and the EU.....	17
2.4.1	NAFTA and EU Compliance with International Norms Regulating Environmental Protection.....	18
2.4.2	Regional Laws on Agriculture and the Environment.....	19
2.5	Conclusion.....	21
3.	Chapter Three: The Impact of Agriculture on the Environment: South Africa Compared to the North American Free Trade Area (NAFTA) and the European Union (EU).....	23
3.1	Introduction.....	23
3.2	Genetic Engineering: An Environmental Risk Assessment.....	24
3.3	Agricultural Waste and Residues: Utilisation and Disposal.....	28
3.4	Agricultural Trade and Climate Change: How Successful is South Africa in Preventing Global Warming?.....	33
3.4.1	Deforestation.....	34
3.4.2	Farming.....	36
3.5	South African Farmland: Environmental Impacts.....	38
3.5.1	Intensive Farming.....	38
3.5.2	Irrigation.....	42
3.5.3	Soil Degradation.....	44
3.6	The Polluting Effects of Agriculture on the Ecosystem.....	47
3.6.1	Air Pollution.....	48
3.6.2	Soil Pollution.....	50
3.6.3	Water Pollution.....	51
3.7	Conclusion.....	54
4.	Chapter Four: Conclusion and Recommendations.....	56
4.1	Conclusion.....	56
4.2	Recommendations.....	58
	Bibliography	60

CHAPTER ONE

INTRODUCTION

1.1 Background

International trade is one activity that is carried on by all countries to different degrees, since no country is self-sufficient to the point of ignoring the rest of the world.¹ The creation of the World Trade Organisation (WTO)² was intended to complement the shortcomings of the General Agreement on Tariffs and Trade (GATT).³ The latter had no doubt been vital in directing countries, particularly member states, in their quest for means of development.⁴ Countries across the globe, especially those of the West, work very hard to impose themselves on the international market. The game is all about gaining access to the global market and getting the upper hand where possible. Countries invest more and more in order to do better than others. In most cases this relates to something where they have a comparative advantage and could acquire a monopoly; but certainly the market sector which they could dominate.⁵

Agriculture is one of those sectors on which a lot of attention is focused, due to its relevance to international trade.⁶ The sector is of significant importance to countries' economies due to the vital role it plays in the economic growth of countries.⁷ The agricultural practices relevant here include crop and animal farming, as well as fishing. The sector has helped to reduce the level of malnourishment across the globe. It is also of great importance as it contributes significantly to global economic growth by providing employment and improving income through trading.⁸ These positive impacts, however, are a mixed blessing. In the United States, for example, it has

¹ Hoyle MSW *The Law of International Trade* (1981) 1.

² The Agreement Establishing the World Trade Organization, commonly known as the 'Marrakesh Agreement', was signed in Marrakesh, Morocco, on April 15, 1994, at the conclusion of the Uruguay Round of Multilateral Trade Negotiations.

³ The GATT resulted from a 1947 meeting of 22 nations in Geneva and it lasted until 1994.

⁴ Palmeter ND *The WTO as a Legal System – Essays on International Trade Law and Policy* (2003) 8.

⁵ Desta MG *The Law of International Trade In Agricultural Products – From GATT 1947 to the WTO Agreement on Agriculture* (2002) 1-2 (hereafter Desta MG (2002)).

⁶ Desta MG (2002) 7-8.

⁷ Johnston BF & Mellor JW 'The role of agriculture in economic development' (1961) 51 *The American Economic Review* 567.

⁸ Tilman D 'Global environmental impacts of agricultural expansion: The need for sustainable and efficient practices' (1999) 96 *Colloquium paper, National Academy of Sciences USA* 5995 - 6 (hereafter Tilman D (1996)).

left the environment with certain concerns. These include, but are not limited to, serious degradation of soil and water resources, thus representing a potential threat to farm productivity and human health.⁹

South Africa as an emerging economy is one of the countries where commercial agriculture is a common practice.¹⁰ The agricultural sector in South Africa does not only boost the country's trading ability and assure regular food supplies, but it is also a high employment sector.¹¹ However, it should be noted that the manner in which the sector is run in South Africa creates mixed impacts on the environment. Thus there are a considerable number of negative impacts resulting from this sector. Amongst others, one critical effect is the threat posed to human health by the use of pesticides in areas around habitats; in northern KwaZulu Natal, for example, Dichlorodiphenyltrichloroethan (DDT) was detected in breast milk. In the same area water is also greatly exposed to pesticides which are said to be much used in the area.¹² Although International Trade Law (ITL) is certainly focused on good and profitable trading relations and activities between countries, it also takes environmental concerns very seriously.¹³

1.2 Objectives and Research Question

The aim of this research is to examine the extent to which the environment is affected by agriculture as a trading activity in South Africa, and to recommend ways of addressing this through regulation. This will be done through an examination of ITL, particularly the legal texts of the GATT and the WTO, with particular attention to the Agreement on Agriculture (AoA) and also the Sanitary and Phytosanitary Measures (SPS).

The main objectives of the research include:

- a) Analysing the agricultural sector according to the GATT and WTO systems.

⁹ Trautman NM, Porter KS & Wagenet RJ 'Modern agriculture: Its effects on the environment' (1985) available at <http://psep.cce.cornell.edu/facts-slides-self/facts/mod-ag-grw85.aspx> [accessed on 09/10/2011].

¹⁰ Rogerson GM 'Urban agriculture in South Africa: Scope, issues and potential' (1993) 30 *GeoJournal* 21.

¹¹ Jooste A & Van Zyl J 'Regional agriculture trade and changing comparative advantage in South Africa' (1999) 94 *US Agency for International Development* 1, 71.

¹² Agricultural Research Council 'Pesticide impact on human and environmental health' (2010) available at <http://www.arc.agric.za/home.asp?pid=947> [accessed on 25/09/2011].

¹³ Louw P *International Trade and the Environment* (1992) 1.

- b) Attempting to establish the role of South Africa in the protection of the environment from agricultural activities.
- c) Studying the WTO's Agreement on Agriculture and SPS measures.
- d) A detailed analysis of provisions favouring or against environmental protection under the GATT.
- e) Making recommendations for a better conservation of the environment from being depleted by agricultural activities.

1.3 Problem Statement

The agricultural sector is undoubtedly very significant to the South African economy. It contributes 2.5% of the country's whole Gross Domestic Product (GDP).¹⁴ It equally employs about 25.2% per cent of the South African population.¹⁵ Beside the positive impacts that the agricultural sector has on the South African economy, there are issues to worry about. The main concern of this research is the fact that the sector has mixed effects on the environment. It is evident that, in the process of achieving the abovementioned successes, the protection accorded to the environment has either been less effective or non-existent in certain areas.¹⁶ Consequently, amongst others, there are challenges, such as, increased carbon dioxide releases in the atmosphere, presence of pathogens and chemicals into our water, and increased levels of greenhouse gas emission into the atmosphere.¹⁷

Thus questions arise regarding the extent to which trade-oriented agricultural activities in South Africa affects human health, the soil and climate change. In addition to examining the manner in which ITL and South African legislation and regulations address issues of environmental

¹⁴ CIA 'The world fact book: GDP – Composition by sector' (2011) available at

<https://www.cia.gov/library/publications/the-world-factbook/fields/2012.html> [accessed on 08/10/2011].

¹⁵ Department of Agriculture, Forestry and Fisheries Republic of South Africa 'Estimate of the contribution of the agricultural sector to employment in the South African economy' (2010) 1 available at

http://www.daff.gov.za/docs/Economic_analysis/Contribution_agriculture_sectorSAeconomy.pdf [accessed on 08/10/2011].

¹⁶ Ingo M & Ng F 'Distortionary effects of state trading in agriculture: Issues for the next Round of Negotiations' (1998) 1 available at

<http://elibrary.worldbank.org/docserver/download/1915.pdf?expires=1351688007&id=id&accname=guest&checksum=97356646D0F6E19B72A3F310C7EC51AD> [accessed on 31/10/2012].

¹⁷ Rodriguez E, Sultan R & Hilliker A 'Negative effects of agriculture on our environment' (2004) 3 *The Traprock* 28 (hereafter Rodriguez E et al (2004)).

concern vis-à-vis agriculture trade, reference will be made to the North American Free Trade Area (NAFTA) and the European Union (EU) for comparative purposes. That is, their degree of effectiveness in keeping the environment safe while profitably regulating and encouraging trade in the agricultural sector.

1.4 Scope of the Research

The research is concerned with how South Africa deals with environmental concerns; specifically the agricultural impacts on human health, soil and climate change. It will be of particular interest to study the WTO's view on what should be done, and what exactly has been done, for agricultural practices to be environmentally friendly. The role of South African law towards achieving the same goal will also be analysed. A comparative study will be carried out, in order to evaluate how successful South Africa as a developing economy is in protecting the environment from a tradeable and profitable sector such as agriculture. For that purpose, this research will examine some trade-oriented agricultural laws and agricultural trade impacts in the NAFTA and the EU. This aims at comparing South Africa's ability as a developing economy in dealing with environmental concerns as compared to the developed world. Other international treaties on environmental protection will also be referred to.

1.5 Significance of the Research

The agricultural sector, as mentioned above, is a boost for the South African economy. It is not only a source of food for national consumption, but offers employment to millions and strengthens South Africa's exporting capacity.¹⁸ The sector, however, produces a considerable amount of adverse effects on the ecosystem, with the most critical ones being soil pollution and ozone depletion.¹⁹

¹⁸ Magagane L, Muronga F, Verster J & Steenkamp E 'Market research on South African agriculture exports' (2008) 2, 3 available at <http://www.daff.gov.za/docs/researchP/MarkResechSAexp.pdf> [accessed on 25/09/2011].

¹⁹ Rodriguez E et al (2004) 30.

It is vital to establish a link between agriculture as a tradeable activity and the environment. In other words the way in which the ecosystem is depleted by agricultural practices needs to be examined.

Under the WTO, the Agreement on Agriculture and SPS measures consider environmental protection as a serious matter that state parties should consider in their trading activities. Nonetheless, the effectiveness of the law in general and ITL in particular on environmental protection vis-à-vis agriculture is worth being examined, in order to determine the extent to which the current regulation is efficient.

1.6 Research Methodology

The research will rely entirely on material available from various sources; several books dealing with the topic do exist, and there is also quite a large amount of relevant material available in law journals, case law, international treaties, statutes, conventions, official reports and electronic materials. Some of the sources will make reference to NAFTA and the EU for comparison purpose, which will be valuable in order to assess South Africa's ability to limit the environmental impacts of agriculture. This research will strive to determine the various viewpoints and to examine them to reveal their relevance to the South African context.

1.7 Preliminary Structure

The research will be dealt with in four chapters:

Chapter One is the introductory chapter which will provide the research background, its objective and an overview of the problem. In addition, it will set out the scope of the research, its significance and the methodology.

Chapter Two will deal with the various regulations available in ITL and other norms, offering environmental protection against agricultural practices.

Chapter Three will focus on the impacts of agriculture on the environment, and this impact will be analysed from two angles, based on two arguments. On one hand, an argument that those involved in the sector are doing their best to keep the environment safe and providing several advantages. On the other hand, an argument that agriculture does not address environmental concerns adequately.

Chapter Four aims to draw a conclusion from the findings of the previous chapters, and to put forward recommendations as regards what should or should not be done to enforce and render ITL more effective, in terms of environmental protection within the agricultural sector. This will be done at the WTO level and off course at a national level, specifically in South Africa.

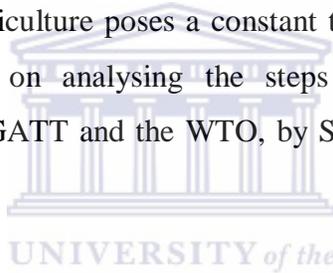


CHAPTER TWO

HISTORICAL BACKGROUND OF THE LAWS REGULATING THE IMPACT OF AGRICULTURE ON THE ENVIRONMENT

2.1 Introduction

The issue of environmental protection has gradually become a matter of international concern in recent times. It should be noted that environmental concerns started far back and by the 1960s became more serious.²⁰ Considering the urgent need to enforce and ensure a certain degree of environmental protection at a global level, it cannot be the sole responsibility of International Environmental Law to enforce the said protection. There is no doubt that under International Trade Law (ITL) a sector like agriculture poses a constant threat to sustainable environment.²¹ This chapter, therefore, focuses on analysing the steps taken towards achieving a safe environment by ITL through the GATT and the WTO, by South African law as well as by the NAFTA/EU environmental norms.



2.2 The Development of Environmental Protection Norms from the GATT to the WTO

Environmental issues, particularly those deriving from the agricultural sector, have over the years become a serious matter of concern to ITL.²² It should be noted that the acknowledgement of such issues, and the need to put in place protective rules, increased as years went by.²³

²⁰ Dunlap RE 'Trends in public opinion towards environmental issues: 1965-1990' (1991) 4 *Taylor & Francis Group* 285 (hereafter Dunlap RE (1991)).

²¹ Clay JW *World Agriculture and the Environment: A Commodity-By-Commodity Guide to Impacts and Practices* (2004) 1 (hereafter Clay JW (2004)).

²² Rodriguez E et al (2004) 3.

²³ Dunlap RE (1991) 1

2.2.1 Environmental Concerns Deriving from Agricultural Practices Addressed Under the GATT 1947

Created in 1947, the GATT aimed at establishing and enforcing international trade rules through dispute settlement,²⁴ and it lasted 47 years. From the objectives of the GATT, it is obvious that from the outset environmental protection, particularly environmental challenges deriving from the agricultural sector, were not accorded sufficient attention. Even though no clear mention was made of the agricultural threats to the environment, texts of the GATT 1947 nonetheless either immediately or at a later stage put in place provisions that could apply even to the enforcement of environmental norms.

Trade and environment issues were paid attention in the GATT for the first time in 1971, and in the same year a GATT expert group on environmental measures and international trade was put in place.²⁵ Accordingly, a link was established between trade and the environment, which are complementary and mutually reinforcing and not incompatible, as some may think, though some conflicts may occur.²⁶

The history of agriculture in the GATT has been a difficult one. However, agriculture was not totally neglected; the drafters of the GATT did not omit to include some provisions that provide an exceptional status to agricultural products, such as Art XVI: 1 which deals with subsidies on primary products, and Arts XI, XII, XIII and XIV dealing with quantitative import restrictions.²⁷ The agricultural topic was brought to different negotiation rounds without success. But finally it was brought closer to the GATT by the Uruguay Round which took place between 1986 and 1993. During this Round parties agreed on the need to achieve greater liberalisation of agricultural trade by, amongst others, ameliorating the competitive environment and reducing the adverse effects that Sanitary and Phytosanitary regulations and barriers have on agricultural trade.²⁸

²⁴ WTO 'The GATT years: From Havana to Marrakech' available at http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact4_e.htm [accessed on 20/02/2012].

²⁵ Wiers J *Trade and Environment in the EC and the WTO A Legal Analysis* (2003) 20 (hereafter Jochem W (2003)).

²⁶ Wiers J (2003) 20.

²⁷ Sharma R 'Multilateral trade negotiations on agriculture - A resource manual, module 4: Agriculture in the GATT: A historical account' available at <http://www.fao.org/docrep/003/x7352e/x7352e04.htm#comm3> [accessed on 12/02/2012] (hereafter Sharma R).

²⁸ Sharma R.

From the above it is quite obvious that the GATT tried to consider trade in agriculture, but did not adequately address the issue of the enforcement of environmental protection. It is possible that its successor will go a step further since it has carried on from where the GATT stopped.

2.2.2 The Evolution of Agricultural Related Norms Towards Environmental Safety Under the WTO

One of the biggest known reforms in international trade is the creation of the WTO on 1st January 1995; this innovation closed, in Marrakech, the Uruguay Round which was launched in 1986.²⁹ It aimed at facilitating trade talks in the most profitable manner for its members; in other words it had to carry on with the objectives of the GATT while ameliorating the areas in which the GATT had failed or never touched upon.³⁰

It is important to note that the WTO is not indifferent to environmental concerns, particularly the fact that it went a step further in its texts to consider environmental challenges deriving from the agricultural sector.

For the purpose of seeking environmental safety, the Agreement on Sanitary and Phytosanitary Measures (SPS) containing regulations on food safety and animal and plant health came into force as part of the WTO agreement.³¹ The SPS aim to ensure and encourage WTO members to always take into account the need to avoid trading activities that are potentially harmful to the environment,³² and one can easily understand that agriculture trade falls within the sectors covered by the SPS. Amongst the environmental protection measures related to the agricultural sector found in the SPS, there is the need to avoid contaminating drinking water, to avoid fish stocks or farm soil from being polluted by heavy materials, and to safeguard biodiversity.³³

Amongst the WTO agreements addressing issues of environmental concern is also the Agreement on Technical Barriers to Trade (TBT), which aims at ensuring that WTO members

²⁹ WTO 'Understanding the WTO: Basics' available at http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact4_e.htm [accessed on 01/03/2012] (hereafter WTO 'Understanding the WTO: Basics').

³⁰ WTO 'Understanding the WTO: Basics'

³¹ WTO 'The WTO agreement series; Sanitary and Phytosanitary Measures' (2010) 1 available http://www.wto.org/english/res_e/booksp_e/agrmtseries4_sps_e.pdf [accessed on 01/03/2012] (hereafter WTO (2010)).

³² WTO Sanitary and Phytosanitary Measures art 5 (2).

³³ WTO (2010) 13.

adopt only measures necessary for the smooth running of international trade, but which are of nature to achieve positive policy goals,³⁴ amongst others relating to the environment.³⁵ Under the TBT, member countries are allowed to take measures capable of protecting the environment, human, animal, plant and health, on condition that these measures do not present unnecessary obstacles to international trade.³⁶ Even though the above does not make direct reference to agriculture, there is not a doubt that it can in one way or another apply to the agricultural sector, since it is obvious that any negative impact arising from this sector is likely to affect the environment.

One other very important WTO agreement, which is of great importance to this research, is the Agreement on Agriculture (AoA)³⁷ which aims at regulating agricultural trade; in other words, its aim is to establish a fair market-oriented trading system in agriculture. It makes it an obligation for member countries to augment market access and to reduce distorting agriculture trade subsidies. It is interesting to mention here that the Agreement also considers non-trade concerns, including food safety and the serious need to ensure environmental protection.³⁸ It recognises in its Preamble the need to protect the environment as well as to assure food security within the sector. The Agreement further permits certain subsidies which concern environmental programmes. In most cases government programmes in developing or low income countries intend to encourage diversification from growing illicit crops, such as, narcotic and other crops which although easier and cheaper to grow constitute a potential danger to the environment.³⁹ Unlike the GATT 1947, one can from the above realise that the WTO has addressed environmental needs much better, and even went further by considering the agricultural sector's environmental impacts.

In order to achieve its environmental goals the WTO Dispute Settlement Body (DSB) receives complaints from its member countries. A good example is one lodged by Brazil regarding the

³⁴ WTO 'Technical Barriers to Trade' available at http://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm [accessed on 01/03/2012].

³⁵ Preamble to the WTO Technical Barriers to Trade (TBT), Para 4.

³⁶ Art 2.2 TBT.

³⁷ The Agreement on Agriculture (AoA) came into effect in 1995

³⁸ WTO 'Agriculture: Explanation' available at http://www.wto.org/english/tratop_e/agric_e/ag_intro01_intro_e.htm#ag_trade [accessed on 02/03/2012].

³⁹ Part IV: Art 6 of the AoA

US's cotton policy and requesting the abolition of an exemption from subsidies.⁴⁰ In 2002 Brazil brought to the WTO DSB a complaint regarding Upland Cotton in US. According to Brazil, credit guarantees granted by the US to Upland cotton producers should be considered as subsidies in terms of Para 6 (b) of annexure to the AoA, which are not allowed by virtue of Art 13 (a) (ii) of same annexure. After consultation, the Compliance Panel reported to the DSB in 2007, that the US had acted contrary to its obligation under Art 5 and 6.3 (c) of the Agreement on Subsidies and Countervailing Measures which expects her to avoid such actions for the sake of a safer environment. Before the conclusion of the case, Brazil and the US notified the DSB in 2010 that they had agreed to set out parameters for discussions on a solution regarding domestic aid programmes to Upland cotton producers in the US.⁴¹

It is worth at this point to examine how far South Africa has gone with environmental protection and that will be the focus of the next section.

2.3 The South African Legal Approach Towards the Protection of the Environment Within the Agricultural Sector

South Africa is certainly not indifferent to the global call to protect the environment, even in the agricultural sector, considering the urgent need to carry on with trading activities while seeking to limit environmental degradation as much as possible. In South Africa, the Constitution attributes legislative and administrative functions to three different and distinct spheres which are interdependent and interrelated: national, provincial and local.⁴² It is important to acknowledge that South Africa considers several global, regional and sub-regional environmental texts, as will be analysed below. The aim of this section is to analyse, within the South African context, the legal provisions offering some considerable protection to the environment within the agriculture sector. This will be dealt with from two different angles; one will focus on environmental protection at the national level, while the other looks at the issue from a purely non-national perspective.

⁴⁰ Simi TB 'Brazil-US Upland cotton dispute: What does it augur for agricultural subsidies' (2005) 2 *Trade Law Briefs* 1.

⁴¹ *US Upland Cotton (Brazil v US)* [2002] WTO DSB DS267

⁴² Hydroelectric power project EIA and SIA requirements of SAPP member countries and relevant development assistance agencies and banks, country studies 'South Africa' available at http://www.saiea.com/dbsa_handbook_update09/pdf/12SouthAfrica09.pdf [accessed on 01/03/2012].

2.3.1 South Africa's Acceptance of the Global, Regional and Sub-Regional Environmental Protection Norms Within the Agricultural Sector.

It is necessary to acknowledge South Africa's efforts to adhere to certain non-national regulations which aim to offer better protection to the environment. This will be done at three levels.

First, a look at the global environmental protection regulations, a good number of which South Africa has ratified. Amongst others there is the Vienna Convention for the Protection of the Ozone Layer (1985). It was initiated by the United Nations Environmental Program (UNEP) in an attempt to raise awareness around the scientific fact that the ozone was depleting at an alarming rate, thus encouraging nations to watch out for any activity which could pose a risk to the environment in general and the ozone layer in particular. Subscribing to the aim of this Convention South Africa acceded to it on 15 January 1990 and ratified it in January 1995.⁴³ On 15 January 1990 South Africa also acceded to the Montreal Protocol on Substances that Deplete the Ozone Layer (1987). The Protocol was adopted mainly to offer better environmental control than the Vienna Convention did.⁴⁴

One very important agreement which is directly related to the agricultural sector is the Convention to Combat Desertification (1994). It is known as the only internationally legally binding convention put in place to combat desertification. South Africa signed it on 9 January 1995 and ratified it in September 1997.⁴⁵

There is also the Stockholm Convention on Persistent Organic Pollutants (POPs) (2001) which South Africa signed on 23 May 2001 and ratified on 4 of September 2002.⁴⁶ The main goal of this Convention is to protect human health and environment from the effects of the POPs, which

⁴³ Van der Linde *Compendium of South African Environmental Legislation* (2006) 558 (hereafter Van der Linden M (2006)).

⁴⁴ Van der Linden M (2006) 558.

⁴⁵ Department of International Relations and Cooperation-RSA 'The Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa (CCD)' (2006) available at <http://www.dfa.gov.za/foreign/Multilateral/inter/treaties/ccd.htm> [accessed on 01/03/2012].

⁴⁶ Secretariat of the Stockholm Convention on Persistent Organic Pollutants United Nations Environment Programme available at <http://www.pops.int/documents/signature/signstatus.htm> [accessed on 26/10/2012].

persist in the environment and bio-accumulate through the food web, causing negative effects on human health and the environment.⁴⁷

Secondly, at the regional level, on 9 July 1996, South Africa as a member of the African Union signed the African Charter on Human and Peoples' Rights (1981) and ratified it on the same date.⁴⁸ The most interesting thing about this Charter as far as this research is concerned, is the fact that in it for the first time the right to an agreeable environment is acknowledged and incorporated in an internationally binding instrument. Art 24 deals distinctively with environmental protection and promotion.⁴⁹

There is also the Constitutive Act of the African Union (2000). This not only acknowledges, but also places strong emphasis on, sound environmental protection and management from any approach (regulatory or rights based). South Africa signed and ratified the Act on 9 July 1996.⁵⁰

Thirdly, at a purely sub-regional level, South Africa is a member of the Southern African Development Community (SADC). On 29 August 1994 South Africa acceded to the SADC treaty of 1992 which provides the foundation of the organisation.

The SADC Protocol on Shared Watercourse Systems (1995) provides for the use of shared watercourse systems for, amongst others, agricultural purposes in the SADC region, demanding proper management and utilisation of shared watercourse systems. South Africa signed it on 28 August 1995 and ratified it on 26 November 1997.

Very important also, is the fact that the SADC has a regional agricultural policy which acknowledges that the agricultural sector features prominently in the regional economy.⁵¹ Within the said policy the need for a sound environment is identified, a cry for environmental protection and security within the agricultural sector is also quite clear.⁵² Countries, including South Africa,

⁴⁷ UNEP 'United Nations Environmental Program chemicals; Persistent organic chemicals' available at <http://www.chem.unep.ch/pops/> [accessed on 01/03/2012].

⁴⁸ South African Human Rights Commission 'Peace is its own reward' available at <http://www.sahrc.org.za/home/index.php?ipkMenuID=16&ipkArticleID=35> [accessed on 05/03/2012] (hereafter South African Human Rights Commission 'Peace is its own reward').

⁴⁹ Van der Linden M (2006) 561.

⁵⁰ Van der Linden M (2006) 562.

⁵¹ SADC 'Regional Agricultural Policy (RAP) country summary agricultural policy review reports' (2001) 1 (hereafter: SADC (2001)).

⁵² SADC (2001) 1.

are encouraged to use national consultants to undertake a review of the agricultural situation, which covers both the management of natural resources and environmental protection. They are also required to consider long term agricultural sustainability, especially concerning land degradation, as well as the effects of agricultural expansion on deforestation, and seed and livestock security.⁵³

From the above, there is no doubt that South Africa as part of the global environment has so far tried to be involved in the struggle against environmental degradation, by becoming part of global, regional and sub-regional organisations, as well as by adhering to their agreements (Conventions, Protocols, Acts, Treaties, etc.) which either directly or indirectly are concerned with protecting and promoting a secure environment within the agricultural sector. Having said a lot on South Africa's efforts to adhere to global, regional and sub-regional environmental norms, it is proper for this research to pay similar attention to how environmental concerns and attempts at its protection are been or have been dealt with within the national regulations or legislation of South Africa.

2.3.2 Environmental Protection Afforded by South African Law

The trade and environment issue is clearly a significant concern for South Africa due to the fact that its growth depends on its export sector, including agriculture.⁵⁴ South Africa sets rules and regulations with the aim to further protect the environment from activities with the potential to damage the environment.

Most important is the consideration accorded to environmental issues by the South African Constitution of 1996⁵⁵ which acknowledges and insists on the need to keep the environment safe. Environmental provisions are included in the Bill of Rights in Chapter 2 of the Constitution. According to the terms of Section 24 of the Act, everyone has the right:

'(a) to an environment that is not harmful to their health or well-being; and

⁵³ SADC (2001) 4.

⁵⁴ Trade and Industry Policy Secretariat /International Institute for Sustainable Development *Trade and Environment: South African Case-Studies* (1999) 7.

⁵⁵ As amended for the 11th time by Second Amendment Act 3 of 2003.

- (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-*
- (i) Prevent pollution and ecological degradation;*
 - (ii) Promote conservation; and*
 - (iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*⁵⁶

These provisions cover also the agricultural sector.

Besides the Constitution, there is some environmental protection regulation at the national level, amongst which is the Environment Conservation Act 73 of 1989⁵⁷ with its main aim to provide for efficient protection as well as controlled exploitation of the environment. The Act provides that a competent authority may declare any zone a protected natural environment and may attribute a name to it. The authority may also declare protection over or change the name of the said protected area when necessary. The main intent of this is to protect the natural environment, particularly land and water, from any activity that is likely to tamper with the environment.⁵⁸

The Act makes provision for the control of environmental pollution, under which it prohibits littering and encourages litter disposal and management of waste.⁵⁹

In Part V the Act urges control of activities that are capable of having adverse effects on the environment, and the Minister of Environmental Affairs and Tourism is charged with the responsibility to identify such activities which could probably be dangerous for the environment, amongst which are land use and transformation,⁶⁰ water use and disposal,⁶¹ and agricultural processes.⁶²

The Act provides for the Minister of Environmental Affairs and Tourism to make regulations which can work towards achieving a safe environment,⁶³ as well as it providing offences and penalties for anyone who fails to comply with the regulations on environmental protection.⁶⁴

⁵⁶ Constitution of the Republic of South Africa, Act 108 of 1996 Chap 2 Art 24.

⁵⁷ As amended for the 10th time by National Heritage Resources Act 25 of 1999.

⁵⁸ Environmental Conservation Act 73 of 1989, Section 16-18 (hereafter Act 73 of 1989).

⁵⁹ Act 73 of 1989, Section 19-20.

⁶⁰ Act 73 of 1989, Section 21(2) (a) .

⁶¹ Act 73 of 1989, Section 21 (2) (b).

⁶² Act 73 of 1989, Section 21 (2) (e).

⁶³ Act 73 of 1989, Section 24-28.

⁶⁴ Act 73 of 1989, Section 29-30.

There are also provisions regarding the growing of and trading in Genetically Modified Organisms (GMOs), particularly the GMOs Act 15 of 1997.⁶⁵ In South Africa a number of national and international regulations regulate the use of GMOs. The main intention is to guarantee that any proposed dealings with GMOs are assessed with consideration of their probable risks to human health and the environment prior to them being undertaken. They also aim at ensuring that permitted activities are carried out in a controlled manner, including, where necessary, strategies to limit or manage any probable risks.⁶⁶ With a view to achieving the above, the national regulations which have been put in place include the Genetically Modified Organisms Act 15 of 1997, the National Environmental Management Biodiversity Act 10 of 2004 with its main aim to monitor and report the environmental impacts of GMOs, and the National Environmental Management Act 107 of 1998.⁶⁷ The international regulations include the Cartagena Protocol which South Africa ratified in 2003 and Codex Alimentarius of which South Africa is a member and follows its guiding principle for the evaluation of the safety of food and feed derived from GMOs.

The South African case law also contributes in one way or another to environmental protection. This was evident in *Trustees, Biowatch Trust v Registrar: Genetic Resources, and Others* (2005) on information and details surrounding biotechnology, particularly compliance with the GMOs Act of 1997. In this case, the respondents were accused by the applicant (Biowatch) of not responding favourably and on time to its request for certain information which would have helped it to establish how safe certain GMOs were. The Court's judgement was in favour of the applicant; implying that information regarding environmental safety should be made available, especially when it concern regulations on environmental safety.⁶⁸ Most recently a groundbreaking judgement was rendered, in connection with environmental protection within the mining sector. For the first time in South Africa, a mining company and its director was fined for violating environmental protection norms. In April 2012, Albrecht Frick who ran Anker Coal & Mineral Holdings was fined R260, 000 after being convicted for contravening the National Environmental Management Act and the Petroleum Resources Development Act. Golfview a mining company also ran by Mr. Frick was fined for tampering with the environment: Amongst

⁶⁵ As amended in 2006 with effect in 2010.

⁶⁶ Genetically Modified Organisms Act of 1997 Art 17.

⁶⁷ As amended in 2012.

⁶⁸ *Trustees, Biowatch Trust v Registrar: Genetic Resources, and Others* (2005) (4) SA 111 (T).

others it mined in a wetland, diverted the Holbankspruit River and its tributary, failed to adequately control pollution onsite and to keep dirty water away from clean water.⁶⁹ With the above case, this research hopes that the law will soon track and bring to justice in the same manner, farmers who fail to treat the environment as expected by the National Environmental Management Act.

For comparative purposes, in order to establish whether or not South Africa has been dealing properly with environmental challenges, it will be reasonable for this research to consider how similar challenges have been or are being dealt with in NAFTA and the EU regional organisations.

2.4 Agriculture and the Environment as Addressed by NAFTA and the EU

It is obvious that environmental protection is a global issue, thus NAFTA and the EU are equally concerned. NAFTA came into effect on 1 January 1994, giving birth to one of the largest free trade areas. Its main goal is to facilitate trade and investment between Canada, Mexico and the United States of America.⁷⁰ The EU was founded in 1945 by six members,⁷¹ with the aim to put an end to recurrent and bloody wars, but by the 1960s it diverted to economical and political goals in order to achieve lasting peace. Its membership also grew as time went by; to date the EU has 27 members and it is one of the most influential actors in international trade.⁷² The first reason why these two areas are chosen for a comparative study is the fact that they belong to two continents other than Africa. Secondly, there is the fact that the world's most powerful economies belong to these two blocks. It is, therefore, necessary for this research to highlight how far environmental concerns are addressed on these two continents and where necessary by the big economies which in one way or the other dispose of better means to tackle the adverse effects of trade on the environment. This section will, on the one hand, seek to look at how international environmental norms are considered by NAFTA and the EU, and, on the other hand

⁶⁹ *Anker Coal/Golfview Mining – Leliesfontein (State v Kruger & others)* available at <http://cer.org.za/wp-content/uploads/2011/12/Golfview-Mining-Leliesfontein.pdf> [accessed on 12/11/2012].

⁷⁰ NAFTA 'NAFTA' available at <http://www.naftanow.org/> [accessed on 20/03/2012].

⁷¹ The founding members are Belgium, France, Germany, Italy, Luxembourg and the Netherlands.

⁷² EU 'The history of the European Union' available at http://europa.eu/about-eu/eu-history/index_en.htm [accessed on 21/03/2012].

their attempts and, particularly, steps taken to introduce rules and regulations capable of keeping the environment safer.

2.4.1 NAFTA and EU Compliance with International Norms Regulating Environmental Protection

As mentioned above, ecological issues are a matter of concern to NAFTA and the EU, and they also take seriously international regulations on environmental protection.

In an attempt to achieve environmental safety as requested at a global level, NAFTA works side by side with the North American Agreement for Environmental Cooperation (NAAEC), which was established on 1 January 1994 to counter the negative effects of liberalised trade under NAFTA and is considered a very effective mechanism in addressing international environmental problems, especially those related to trade liberalisation and globalisation.⁷³

NAFTA takes environmental issues seriously and member countries are signatories to most environmental protection regulations, as is South Africa. These include the Vienna Convention for the Protection of the Ozone Layer (1985) and the Montreal Protocol on Substances that Deplete the Ozone Layer (1987), amongst others.⁷⁴

The EU on its part is believed to be increasingly dedicated to a global ecological role, and in compliance with global environmental protection, member states are required to implement levels of environmental protection as agreed among them.⁷⁵

The Treaty on the European Community is very clear in encouraging its member states to embark on the promotion of useful measures at international level to handle regional or global environmental problems.⁷⁶ Thus, just like NAFTA and South Africa, the EU member countries have ratified a considerable number of norms targeting environmental safety, including the

⁷³ Yang T 'The effectiveness of the NAFTA Environmental Side Agreement's citizen submission process: A case study of the Metales y Derivados matter' (2004) 1 available at <http://www.ecologiaradical.com.mx/VB/Biblioteca/The%20Effectiveness%20of%20the%20NAFTA%20Environment%20Side%20Agreement%E2%80%99s%20Citizen%20Submission%20Process.%20%20A%20Case%20Study%20of%20the%20Metales%20y%20Derivados%20Matter.pdf> [accessed on 05/04/2012] (hereafter Yang T (2004)).

⁷⁴ Strydom HA 'The legal principal relating to climate change' available at <http://www.eolss.net/Sample-Chapters/C14/E1-36-10-00.pdf> [accessed on 05/04/2012].

⁷⁵ Preamble to the treaty on European Union.

⁷⁶ Treaty on EU art 174 (1) para 5.

Convention to Combat Desertification (1994) and the Stockholm Convention on Persistent Organic Pollutants (POPs) (2001).

The above indicates that, in one way or another, South Africa and the two regional blocks are willing to carry on with trade in areas like the agricultural sector while taking on a common goal, viz. to comply with the international call using environmental norms to address environmental issues. It is, however, necessary to analyse the manner in which the two blocks have put in place their own regulations to address the same issues.

2.4.2 Regional Laws on Agriculture and the Environment

As mentioned above, the adverse effects of agriculture on the environment are also a problem to NAFTA and the EU. For that reason both regions have put in place a number of regulations and dispositions to counter environmental degradation, most of which pursue objectives similar to those of South Africa.

On 4 October 1992, when Bill Clinton, the then USA President, made a speech on NAFTA, he admitted that environmental protection was a matter of concern.⁷⁷ This could be one explanation why NAFTA and its members have passed many laws with the aim of making the environment safer. The NAAEC was established at the same time as the creation of NAFTA. Its main objective was to deal particularly with issues affecting the environment, especially from the trading sector, which no doubt covers several areas, amongst which agriculture, which is very important in boosting trade in the region.⁷⁸ The NAAEC permits private individuals to file petitions with the North American Commission for Environmental Cooperation (CEC) regarding a party's failure to actually enforce its environmental laws; by 1995 forty-seven such petitions were filed.⁷⁹

In NAFTA there are what are known as Technical Regulations and Voluntary Standards. Technical regulations are national or international government enforced legal requirements imposed for health, safety, or environmental reasons, while voluntary standards are nationally or

⁷⁷ Charnovitz S 'The NAFTA Environmental Side Agreement: Implications for environmental cooperation, trade policy, and American treaty-making' (1994) 8 *Temple International and Comparative Law Journal* 1(hereafter Charnovitz S (1994)).

⁷⁸ Charnovitz S (1994) 3.

⁷⁹ Yang T (2004) 1.

internationally accepted procedures and guidelines adopted with a view to maintaining consistent quality.⁸⁰ The target of the above is to limit environmental degradation as much as possible by encouraging member countries of the NAFTA to adopt measures that will be environmentally friendly within the food production sector.⁸¹

The EU, for its part, is not quite different from NAFTA and South Africa as it has in many ways also put in place several regulations to ensure and enforce environmental protection in the European region.

European environmental law seeks to afford support and create conditions for prevention against degradation and pollution of, and effects upon, the environment.⁸²

In the EU there is a belief that improper agricultural practices and land use can equally have serious adverse effects on natural resources; such practices include soil, water and air pollution. To counter them the EU has adopted what is known as its Common Agricultural Policy (CAP). The CAP has singled out some key areas in which it intends to achieve its aim to take action by protecting and enhancing what it terms the “EU Rural Heritage”. These areas include: biodiversity and the conservation and improvement of natural farming and forestry systems, and habitual agricultural landscapes; and the use and management of water and dealing with climate change. Thus, for the EU to achieve its target through the CAP, it ensures that its rules are well-matched with environmental requirements and that the CAP measures promote the development of agricultural practices that seek to preserve the environment and safeguard the countryside. Farmers are equally encouraged to keep on with the good work by playing an active and positive role in maintaining the ecosystem and countryside. The above will be achieved by first targeting agro-environment schemes which provide aid and rural development measures that promote environmentally sustainable agricultural practices. Secondly, by enhancing compliance with environmental laws; this by sanctioning non-respect of these laws by farmers through a cutback in support payments from the CAP.⁸³

⁸⁰ Bredahl ME & Holleran E ‘Technical regulations and food safety in NAFTA’ 72 available at <http://ageconsearch.umn.edu/bitstream/16906/1/ag970071.pdf> [accessed on 22/03/2012] (hereafter Bredahl ME & Holleran E).

⁸¹ Bredahl ME & Holleran E.

⁸² Home R ‘A short guide to European environmental law’ (2007) 4 *Papers in Land Management* 6.

⁸³ European Commission Directorate-General for Agriculture and Rural Development ‘The Common Agricultural Policy explained’ 10.

The Treaty on the European Union makes things very clear; it recognises that its common market extends to trade in products of the soil, in other words, agriculture.⁸⁴ This implies that trade in agriculture is indeed part of the EU targets. As far as environmental protection is concerned, when talking of agriculture, it demands the assurance of a fair standard of living for all involved in the agricultural sector;⁸⁵ and the Treaty equally dedicates its Title XIX to the environment, in terms of which the European Community is expected to follow the community's policy on the environment, which requires the preservation, protection, and improvement of the quality of the environment and the protection of human health.⁸⁶

The EU case law cannot be left out as it has greatly contributed towards achieving a safe environment in the region through several cases, amongst which the case concerning the Netherlands⁸⁷ in which the European Court of Justice (ECJ) held that the respondent, College voor de Toelating van Gewasbeschermingsmiddelen en Biociden and others, was in violation for not making available information as requested by the plaintiff, Stichting Natuur en Milieu. It was actually environmental information which would have helped in protecting the environment as it would have revealed some vital information for the public to have a clear idea of plant protection substances and biocides, and the plant in question was lettuce meant for human consumption.

This is a clear sign that, in as much as the community aims at improving trade in agricultural products as mentioned above, it also seeks to limit or evade environmental degradation through its laws and regulations.

2.5 Conclusion

Looking at all that has been said above, one can easily agree that efforts have been made to enforce environmental protection, from the GATT/WTO to South Africa via NAFTA and the EU. This implies that the protection and promotion of the ecosystem can be handled at any level, be it at the global, regional or national level. It can also be realised that environmental protection can be achieved through written law or case law at any level (global, regional or national). It can

⁸⁴ Treaty on EU art 32 (1).

⁸⁵ Treaty on EU art 33 (1)(b).

⁸⁶ Treaty on EU art 174 (1).

⁸⁷ *European Union Environment (Stichting Natuur en Milieu v College voor de Toelating van Gewasbeschermingsmiddelen en Biociden and others)* [2010] the EU Court of Justice C-266/09.

equally be added that the desires of countries to improve their trade, particularly an increase in agricultural production, has not diverted countries from noticing the threat that this could pose to the environment. Again, as can be noticed from the analysis above, it is a reality that environmental concerns may not only be addressed by the IEL, but can very well be handled by the ITL.

Even with much laws and regulations on paper, one could still be left with a question as to whether these rules and regulations are actually effective in practice. The chapter to follow will seek to highlight the extent to which environmental protection has been enforced in the agricultural sector in South Africa, though with reference to the NAFTA and the EU for comparative purpose.



CHAPTER THREE

THE IMPACT OF AGRICULTURE ON THE ENVIRONMENT: SOUTH AFRICA COMPARED TO THE NORTH AMERICAN FREE TRADE AREA (NAFTA) AND THE EUROPEAN UNION (EU)

3.1 Introduction

Having looked at the laws regulating the possible effects of agriculture on the ecosystem in the previous chapter, the focus of the present chapter will be the agricultural impacts proper, that is, the manner in which agricultural trade has affected the living environment. Agricultural trade is unquestionably a vital sector in the economic growth of countries. Although that importance has declined over time, agriculture nonetheless is still very significant to countries' economies.⁸⁸ It contributes to countries' exporting capacity, and has placed South Africa amongst the five top fruit exporters in the world and contributes to 8% of the country's total exports.⁸⁹ The sector employs 25.2% of the population and contributes 2.5% to the country's GDP. The position is not very clear in NAFTA though agriculture is much practised there.⁹⁰ In the EU, on the other hand, half of its land is used for agricultural purposes,⁹¹ which is the source of income for 20% of the EU's population, provides 8.3 % of total employment and, even better than South Africa, it contributes 4.4% to the total EU GDP.⁹² In the EU agriculture is used for much more than just trading purposes or food production; farming is of great importance for the EU's natural environment considering the fact that it creates and maintains semi-natural habitats, shapes the

⁸⁸ Meijerink G & Roza P 'The role of agriculture in economic development' (2007) *Markets, Chains and Sustainable Development Strategy & Policy paper 4 2* available at http://www.boci.wur.nl/NR/rdonlyres/98CCE2E3-0FA2-4274-BCA0-20713CA1E125/62608/Fullreport4_Meijerink_Roza.pdf [accessed on 02/04/2012].

⁸⁹ South Info 'South African agriculture' available at <http://www.southafrica.info/business/economy/sectors/agricultural-sector.htm> [accessed on 02/04/2012].

⁹⁰ Difficult to obtain figures since statistics are mostly available for individual member countries.

⁹¹ European Commission-Directorate General for Agriculture 'Agriculture and the environment' (2003) 1-2 available at http://ec.europa.eu/agriculture/publi/fact/envir/2003_en.pdf [accessed on 02/04/2012].

⁹² Europedia 'EU agricultural policy' available at http://europedia.moussis.eu/books/Book_2/6/21/index.tkl?all=1&pos=297 [accessed on 01/04/2012].

landscape, provides a home for the EU's rich wildlife, as well as playing a vital role in maintaining the environment in a healthy state.⁹³

Though this chapter seeks to outline how secure or unsound the environment has become or is likely to become due to agricultural activities, its main aim is to analyse the extent to which the laws or regulations discussed in the previous chapter have been enforced. In other words, how effective have they been in protecting the environment in the face of agricultural trade, mainly in South Africa, but also with reference to NAFTA and the EU with a view to determining how effective South Africa as an emerging economy is in terms of environmental protection when compared to more developed economies. Several areas requiring a certain amount of legal enforcement will be considered. These include water, soil and air, which in one way or another can indicate how sound the entire environment is, depending on how sound they are as components of the ecosystem. In analysing the said three key areas, the focus will be placed on genetic engineering, waste management, human health, climate change, deforestation, intensive farming, irrigation, pollutants, and soil degradation.

3.2 Genetic Engineering: An Environmental Risk Assessment

The world's population is constantly on the rise requiring a need for an alternative means to feed the world's more than 7 billion people. That alternative means happens to be genetic engineering (GE).⁹⁴ GE, also known as genetically modified organisms (GMOs) or genetically modified (GM) crops, has to do with altering living organisms, that is, the capacity of science and technology to alter organic processes in any way that can be of benefit to humanity.⁹⁵ GE has been going on for more than a century.⁹⁶ But this research is much interested in what is termed modern GE which began in the second half of the 20th century. A particular focus is the

⁹³ Leguen de Lacroix E 'Agriculture and the environment' (2003) 2 available at http://ec.europa.eu/agriculture/publi/fact/envir/2003_en.pdf [accessed on 03/04/2012].

⁹⁴ Peacock KW *Biotechnology and Genetic Engineering* (2010) 4 (hereafter Peacock KW (2010))

⁹⁵ Wuger D 'The many faces of modern biotechnology' in Wuger D & Cottier T (eds) *Genetic Engineering and the World Trade System, World Trade Forum* (2008) 3 (hereafter Wuger D in Wuger D & Cottier T (eds) (2008)).

⁹⁶ The South African Freeze Alliance in Genetic Engineering 'Where in South Africa are GE crops growing?' 1 available at http://www.safeage.org/index.php?option=com_content&view=article&id=54&Itemid=43 [accessed on 06/04/2012] (hereafter The South African Freeze Alliance in Genetic Engineering).

development of GM crops which has been going on for decades, and, most significantly, became well known to the world in the 1990s.⁹⁷ In South Africa:

*'The Department of Agriculture first granted a permit for GE cotton field trials in 1992. By Feb 2000, 165 field trials permits and 4 commercial insect-resistant GE crops had been granted general release permits i.e. GE plants are widely grown.'*⁹⁸

In the NAFTA region, and in the USA in particular, in 1992

*'... the U.S. Food and Drug Administration (FDA) approved the first genetically engineered food to be approved for sale and marketing in the United States. In the eight years since a new tomato, Calgene's Flavr Savr, gained this distinction, scientists have created—and companies have marketed—a wide range of genetically modified (GM) crops that have now become commonplace in farms and supermarkets across the country.'*⁹⁹

Unlike in South Africa and NAFTA, approval of the first GM crop in the EU occurred in 1994; that was in France and the crop was tobacco,¹⁰⁰ since;

*'...the EU has taken a far more cautious approach to GMOs, dragging out the approval processes for new GM foods and insisting that such products be labelled as such for consumers.'*¹⁰¹

But the main question that is worth being asked should be: how safe are GMOs actually for the environment as a whole and human health in particular, considering the fact that they are somehow different from conventional agricultural crops.

⁹⁷Lurquin PF *High Tech Harvest: Understanding Genetically Modified Food Plant* (2002) xvi-xvii.

⁹⁸ The South African Freeze Alliance in Genetic Engineering 1

⁹⁹ Pollack MA & Shaffer GC 'Biotechnology: The next transatlantic trade war?' (2000) 23 *The Washington Quarterly* 41 (hereafter Pollack MA & Shaffer GC (2000)).

¹⁰⁰ American Public Media 'History of genetic engineering' (2012) available at http://americanradioworks.publicradio.org/features/gmos_india/history.html [accessed on 10/04/2012].

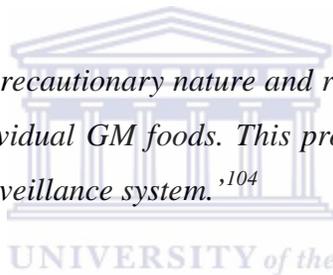
¹⁰¹ Pollack MA & Shaffer GC (2000) 41.

On the one hand, it is believed that nothing is done by scientists that would not occur in nature, and that any unintended consequences to human health or the environment can be technologically managed.¹⁰² Also, in countries like South Africa, GM crops are believed to be less costly to grow, pest and herbicide resistant, have higher yields than non-GM crops, and contribute to poverty alleviation and food security; amongst others they include Bt cotton and Bt maize.¹⁰³ Some even argue that no differences exist between GM and non-GM crops; Professor Liam Donaldson and Sir Robert May wrote:

· Many of the issues raised by foods resulting from genetic modification are equally applicable to foods produced by conventional means. For example, potential nutritional imbalances or allergic effects could occur from either type of food.

· There is no current evidence to suggest that the GM technologies used to produce food are inherently harmful.

· We are reassured by the precautionary nature and rigor of the current procedures used to assess the safety of individual GM foods. This process could be strengthened by the development of a health surveillance system.¹⁰⁴



On the other hand, there are fears that modifying DNA puts lives at risk, although such risks are largely based on presumptions. Critics of and militants against GE crops are determined to make their voice heard regarding the possible risk and threat that production of GMOs can pose to the environment and human health. Interesting enough, the idea of risk assessment of GMOs was discussed for the first time at a conference held in Asilomar in 1975.¹⁰⁵ Most methods employed have the potential to provoke unintended effects in plants and animals which will be consumed by humans. Thus:

¹⁰² Wuger D in Wuger D & Cottier T (eds) (2008) 3.

¹⁰³ Qaim M & Zilberman D 'Yield effects of genetically modified crops in developing countries' (2003) 299 *Science* 901, see also Peacock KW (2010) 5.

¹⁰⁴ Professor Donaldson L & Sir May R 'Health implications of genetically modified foods' (1999) available at http://www.biotech-info.net/gmfoods_health_implications.pdf [accessed on 06/04/2012].

¹⁰⁵ Venneria E, Fanasca S, Monastra G, Finotti E, Ambra R, Azzini E, Durazzo A, Fodai MS & Maiani 'Assessment of the nutritional values of genetically modified wheat, corn, and tomato crops' (2008) 56 *Journal of Agricultural and Food Chemistry* 9206 (hereafter Venneria E et al (2008)).

*'Genetic engineering could result in potential toxicity, possible antibiotic resistance from GM crops, potential allergenicity and carcinogenicity from consuming GM foods, and alteration in nutritional quality of foods, in particular regarding the composition of critical macro-, micro-, and antinutrients. Foreign genes might alter the nutritional value of foods in unpredictable ways by decreasing levels of some nutrients while increasing levels of others.'*¹⁰⁶

However, in order to avoid or limit such risks, there are a considerable number of regulations for that purpose. The WTO's SPS Agreement sets the basis within international trade for scientific evaluation of products capable of adversely affecting the environment, although it does not properly address the particular concerns with modern biotechnology.¹⁰⁷ In South Africa, in order to regulate the cautious and potentially liable use of GM crops, the Genetically Modified Organisms Act 15 of 1997¹⁰⁸ was passed. In the NAFTA region, however:

*'At the time of the NAFTA agreement, in 1992, few people were aware of the potential issues related to GMOs and how they might influence trade. The Agreement therefore makes no mention of the rules for adoption of transgenic plants. NAFTA does however potentially touch the issue in two respects. First, the NAFTA Agreement did address the issue of SPS regulations, anticipating the eventual WTO/SPS Agreement...'*¹⁰⁹

The NAFTA member countries do however possess national regulations on GMOs.¹¹⁰ In the EU the regulation of GMOs, takes more seriously the risks such crops could pose. For instance the EU introduced rules for labelling of GM food. It should also be recalled that the EU initially

¹⁰⁶ Venneria E et al (2008) 9206, see also Bennett R, Ismael Y, Morse S & Shankar B 'Reductions in insecticide use from adoption of Bt cotton in South Africa: Impacts on economic and toxic load to the environment' (2004) 142 *The Journal of Agricultural Science* 666-7.

¹⁰⁷ Wuger D in Wuger D & Cottier T (eds) (2008) 6.

¹⁰⁸ As amended by the Genetically Modified Organisms Amendment, Act 23 of 2006.

¹⁰⁹ Joslin T & Babinard J 'The political economy of GMOs: Emerging disputes over food safety, the environment and biotechnology' (1999) 24 a Draft prepared for discussion with the GMO project group, Department of Agricultural Economics, University of Illinois, Available at <http://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CFwQFjAA&url=http%3A%2F%2Fcite-seerx.ist.psu.edu%2Fviewdoc%2Fdownload%3Fdoi%3D10.1.1.189.1067%26rep%3Drep1%26type%3Dpdf&ei=dly7T-7wE8KDhOfp5YCACO&usg=AFQjCNHLiJTgbE8iJFyaMccey--MCyylIA&sig2=e6UN9L7z17tWg55DPK-0WQ> [accessed on 10/04/2012].

¹¹⁰ Gonzalez AG *The Protection of Maize Under the Mexican Biosafety Law: Environment and Trade* (2010) 171-2.

opposed GM crops, but finally gave in in 1998 but not without putting in place tough legislation in view to limiting the risks arising from GE.¹¹¹ The EU's stand regarding GM crops probably explains its reticence on GMOs, which, amongst other things, has resulted in its difference with the US over an EU ban on hormone treated beef imports from the US. The US actually took legal action before the WTO against the EU, insisting that the EU ban was inconsistent with the SPS Agreement as it was not based on scientific fact. The battle dragged on for a while and the EU appealed the initial decision. Unfortunately the WTO appellate body ruled in favour of the US saying that the ban constituted a disguised international trade barrier as it was not based on a scientific risk assessment.¹¹² This is one clear indication that, although GE might be a risk to the environment, the EU and many other critics will find it difficult to defend their stand as it is quite difficult if not impossible for now to present scientific evidence in support thereof.

The following section, unlike the previous is based on facts, and does not necessarily require scientific evidence to prove its impacts on human health and the environment as a whole.

3.3 Agricultural Waste and Residues: Utilisation and Disposal

Agricultural trade is likely to produce a considerable amount of waste, considering the load of fertilizers used as well as animal waste.¹¹³ Such waste requires some management, that is, how to deal with the waste in a way that it does not affect the environment negatively. Waste can be classified into two categories: general waste which does not pose any immediate threat or hazard to the ecosystem or health, and hazardous waste which contains elements that may be detrimental to both human health and the environment.¹¹⁴ It is vital at this point to define “waste”, because it might be difficult to determine the impact of agricultural waste if one cannot really understand what waste is. The definition of “waste” is crucial due to the fact that what is considered by one party as waste might not be perceived similarly by the other.

¹¹¹ Giannakas K “The new EU regulation on GMOs: Causes and consequences” (2003) available at http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1124&context=agecon_cornhusker [accessed on 11/04/2012].

¹¹² *EC-Hormones (US v European Communities)* [1997] WTO DSB DS26.

¹¹³ Tilman D (1999) 5997-8.

¹¹⁴ South African Waste Management Information Centre ‘Approach to waste in South Africa’ available at <http://www.sawic.org.za/?menu=17> [accessed on 11/04/2012].

*'Instead the question of whether or not the substance concerned is to be regarded as waste has to be determined on a case-by-case basis in the particular circumstances.
... However, the fact that a substance is destined for one of the waste disposal or recovery operations may be an indicator as to whether or not it is waste.'*¹¹⁵

In South Africa, the Minister of Environmental Affairs and Tourism defined waste according to the terms of the Environmental Conservation Act 73 of 1989 as:

'an undesirable or superfluous by-product, emission, residue or remainder of any process or activity, any matter, gaseous, liquid or solid or any combination thereof, which:

(a) is discarded by any person; or

(b) is accumulated and stored by any person with the purpose of eventually discarding it with or without prior treatment connected with the discarding thereof; or.....

*(d) is stored by any person with the purpose of recycling, re-using or extracting a usable product from such matter...'*¹¹⁶

In the NAFTA region's regulatory document, clear mention is made of substances that are prohibited or are considered as hazardous waste but no definition of the word "waste" is available; attempts to define "waste" are made at national level in member countries.¹¹⁷

An attempt to provide a suitable definition of waste was made by the European Court of Justice in a case where Arco Chemie Nederland Ltd (hereafter referred to as ARCO) appealed a decision refusing it the right to export LUWA-bottom. The facts of the case state that LUWA-bottoms are one of the by-products of the manufacturing process utilised by ARCO:

'In addition to propylene oxide and tertiary butyl alcohol, that manufacturing process produces a flow of hydrocarbons containing molybdenum. The molybdenum comes from the catalysts used to produce propylene oxide. The molybdenum is extracted from the

¹¹⁵ Thornton J & Beckwith S *Environmental Law* 2 ed (2004) 186 (hereafter Thornton J & Beckwith S (2004)).

¹¹⁶ Kula-Seiteisho J & Wiechers H 'National waste management South Africa: Recycling component' (2006) *WOPRR Baseline Study Report & Implementation Plan* 1.

¹¹⁷ Slocum R 'Rethinking hazardous waste under NAFTA' (2009) available at http://ban.org/library/Features/090810_rethinking_hazardous_waste_under_nafta.html [accessed on 02/04/2012] (hereafter Slocum R (2009)).

*flow of hydrocarbons in a dedicated plant and the process produces the substance which ARCO describes as LUWA-bottoms.*¹¹⁸

ARCO actually requested administrative authorisation from the Minister for Housing, Planning and Environment to export 15 000 000 kg of LUWA-bottoms to Belgium, as ARCO did not consider them as waste since they contained a calorific value of between 25 and 28 MJ/kg, and were intended to be used as fuel in the cement factories. The Minister could not grant the authorisation since it was doubted whether LUWA-bottoms, which were a by-product could be exported according to the EU legislation. The previous complaint by ARCO before the national court in The Netherlands was rejected on the grounds that substances would be classified as waste only if they are transferred directly by their initial producer or to another person who, without altering the nature of the substances, uses them as to 100% in a fabrication or refining process in place of raw material, for example. The Fifth Chamber of the European Court in its judgment followed the same direction as the national court and, interestingly gave a clear indication to ARCO regarding the definition of “waste”, stating that:

‘The fact that a substance used as fuel is the residue of the manufacturing process of another substance, that no use for that substance other than disposal can be envisaged, that the composition of the substance is not suitable for the use made of it or that special environmental precautions must be taken when it is used may be regarded as evidence that the holder has discarded that substance or intends or is required to discard it within the meaning of Article 1(a) of that directive.’

The Court adds further that anything that is discarded or intended or required to be discarded constitutes waste.¹¹⁹

¹¹⁸ EUR-Lex Access to European Union Law ‘Judgment of the Court (Fifth Chamber) (2000) available at http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi:celexplus!prod!CELEXnumdoc&lg=en&numdoc=61997CJ0418 [accessed on 12/04/2012].

¹¹⁹ *ARCO Chemie Nederland Ltd et al v Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer et al* [2000] EC Rep I-4475.

From the above definitions, it is clear what waste is. The focus of this section is to analyse the real effects of agricultural waste on the environment, that is, if waste management has been successful.

In South Africa, just like in Northern America and the EU, agricultural activities can yield a considerable amount of waste, which in certain cases could be very useful to the agricultural sector itself and to the whole community too. Waste, such as, remains from crops and or animal waste, like dung, are recycled and can be used in the production of fertilizer which is itself vital for an increase in crop production.¹²⁰ Furthermore, similar waste can be used in the production of fuel, that is, biogas technology which enables the transformation of certain agricultural waste into biogas for electricity generation which is an additional source of energy.¹²¹

Agricultural waste can also be very dangerous to the environment if poorly treated. Some waste, as mentioned above, may require regulation, because it is at times unwanted, due to the fact that it represents a potential risk to the environment. Such requires special or enhanced regulation, because it is either dangerous or could become dangerous, and this constitutes what is termed “hazardous waste”. “Hazardous” implies that the waste could be explosive, highly flammable, an irritant, toxic, carcinogenic, or infectious.¹²² In the agricultural sector chemicals, such as pesticides, are very useful in the sense that their use helps to control the growth and proliferation of undesirable organisms which can cause serious damage to crops.¹²³ Some of these substances if not disposed of well could be dangerous to the environment.

In an attempt to provide for better waste management, the South African Department of Agriculture, Forestry and Fisheries put in place a policy named “Pesticide Management Policy for South Africa” which aims to see to it that sound internationally scientific criteria are used to safeguard the environment against waste derived from pesticides. And much attention will be

¹²⁰ Fidei S ‘Terra victus’ (2011) 1-3 available at https://docs.google.com/viewer?a=v&q=cache:E6JhDRyjcI4J:www.homeveggiedome.co.za/attachments/Terra_Victus_trade_prospectus_v4.docx+&hl=en&gl=za&pid=bl&srcid=ADGEESjh_00MpzaNfLvCFGUbjGhli_S3SHTcngdIkl-Im3yqerK1d5quuSWUtHQJMHokhkOKcY1IMxxhDZ7Vz0qQKYCsKPxx8YGTEW-3nvtvZfXbjDqBStaqtP4SGw8OBiLyb508Rh&sig=AHIEtbTg_SKSSkquHj5hg80_8cF8XnFIPA&pli=1 [accessed on 15/04/2012].

¹²¹ Enviroplus ‘Engineering for a clear future’ (2008) available at <http://www.enviroplus.co.za/index.php?a1=70> [accessed on 15/04/2012].

¹²² Thornton J & Beckwith S (2004) 192.

¹²³ Department of Agriculture, Forestry and Fisheries ‘Pesticide Management Policy for South Africa’ (2010) Government Gazette No. 33899 1 (hereafter Department of Agriculture, Forestry and Fisheries (2010)).

focused on those wastes that pose a severe risk to the environment and should rather be restricted or banned, namely, pesticides classified by the World Health Organisation as extremely hazardous and which contain endocrine disrupting properties, and persistent organic pollutants (POPs), which have carcinogenic and immunotoxic potential.

The Policy also mentions that South Africa has banned all POPs listed under the Stockholm Convention on Persistent Organic Pollutants. It insists that all pesticides be labelled and encourages long term monitoring programmes and research in order to evaluate the impacts of certain pesticides which have the capacity to accumulate in the environment and produce detrimental effects. According to the above, it is obvious that in an attempt to make sure that toxic wastes are disposed of and other waste are properly managed, the South African Government is enforcing several laws, including the Hazardous Substance Act 15 of 1973, the Environmental Conservation Act 73 of 1989, the Atmospheric Pollution Prevention Act 45 of 1965, and the National Environmental Management Act 107 of 1998. There is also the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal to which South Africa is a signatory.¹²⁴ The issue here is whether this policy has had any effect, and that will be discussed below when analysing soil and water pollution.

In NAFTA, there is no rule for waste management which applies to the region as a whole; instead based on the text of North American Agreement on Environmental Cooperation (NAAEC), member countries try to manage waste at national level. In some cases two countries collaborate in waste management: for instance, about 50% of US hazardous waste by volume is exported to Mexico for treatment.¹²⁵

Contrary to NAFTA, in the EU waste management is a matter of concern to the entire Union and not to individual member states. It is believed in the EU that it is not viable to stockpile waste and that destroying it is not the best solution either due to polluting residues emissions that will result from destruction. Thus, it is best to stop the production of such waste by recycling it where viable waste treatment methods are available.¹²⁶ About 2 tonnes of waste, including hazardous waste, are produced per year in the EU, with agricultural waste constituting the largest in terms

¹²⁴ Department of Agriculture, Forestry and Fisheries (2010) 7-10.

¹²⁵ Slocum R (2009).

¹²⁶ Europa 'Summaries of EU legislation: Waste management' available at http://europa.eu/legislation_summaries/environment/waste_management/index_en.htm [accessed on 14/04/2012].

of quantity.¹²⁷ Similar to waste management in South Africa, the EU also recycles agricultural waste in profitable ways: some is used to make fertilizers, while some is used to generate energy, for instance the use of agriculture residues as raw material in the generation of power.¹²⁸ In so doing it is obvious that the EU has to an extent complied with and enforced the regulations available at the global level and within the Union for environmental protection.

It should however be recognised that waste management has not always been a positive story to tell, and that its poor management in several instances has generated some serious negative impacts on the environment. A clear example of this is the agriculture waste illegally disposed of in the Mooi River in Kwazulu-Natal which led to soil and water contamination.¹²⁹ Poor waste management will be examined in greater detail at a later stage when environmental pollution and soil degradation as consequences of agricultural trade will be analysed.

3.4 Agricultural Trade and Climate Change: How Successful is South Africa in Preventing Global Warming?

Even if climate change is a topic mostly dealt with under Environmental Law, it has become relevant to Trade Law, too. As agricultural trade does impact on climate change, the WTO is quite concerned with climate change.¹³⁰ This is as a result of the serious effects that trade may have on the environment in particular and on climate change as a whole. In addition possible effects of climate change on trade and agriculture in particular are not to be neglected.¹³¹ The focus of this section is to reveal the extent to which South Africa has been effective in dealing with climate change while carrying out its agricultural activities.

¹²⁷ European Commission 'EU focus on waste management' (1999) *Office for Official Publications of the European Communities* 7.

¹²⁸ Jager-Waldau A, Szabo M, Scarlet N & Monforti-Ferario F 'Renewable electricity in Europe' (2011) 15 *Renewable and Sustainable Energy Reviews* 3709.

¹²⁹ Dr. Buthelezi M 'African stockpiles – agricultural waste' (2007) 5 available at <http://www.pmg.org.za/minutes/20071120-national-nuclear-regulator-annual-report-200607-briefing-0> [accessed on 06/04/2012].

¹³⁰ WTO 'Activities of the WTO and the challenge of climate change' available at http://www.wto.org/english/tratop_e/envir_e/climate_challenge_e.htm [accessed on 17/04/2012].

¹³¹ Jackson LA 'Agricultural trade and climate change: Can the WTO promote resilience in the face of uncertainty' (2008) 1 *Georgetown Journal of International Affairs* 25.

3.4.1 Deforestation

In South Africa agriculture is an extensive activity which has a remarkable effect on global warming.¹³² Usually plants absorb a considerable amount of carbon dioxide (CO₂), while releasing oxygen into the atmosphere.¹³³ More plants in existence equally imply a decrease in the organic carbon in the soil, thus neutralising the increased concentration of atmospheric CO₂,¹³⁴ which is one of the gases that make up greenhouse gas (GHG) which contributes to the gradual warming of the earth.¹³⁵ In South Africa, agriculture together with forestry and land use account for 6% of GHGs.¹³⁶

Agriculture can represent a potential threat to the environment as a whole and climate change in particular, when forests are destroyed for growing of crops. “Deforestation” could be defined as the destruction of indigenous forests and woodlands either by simply cutting them down or by burning.¹³⁷ Even though forests can play a very vital role in preserving positive climatic conditions by storing a considerable amount of carbon, the reverse can equally be true:

‘...when forests are logged or burnt, that carbon is released into the atmosphere, increasing the amount of carbon dioxide and other greenhouse gases and accelerating the rate of climate change. So much carbon is released that they contribute up to one-fifth of global man-made emissions, more than the world's entire transport sector.’¹³⁸

¹³² Letete T, Guma M & Marquard A 'Information on climate change in South Africa: Greenhouse gas emissions and mitigation options' 9 available at http://www.erc.uct.ac.za/Information/Climate%20change/Climate_change_info-complete.pdf [accessed on 17/04/2012].

¹³³ Botkin D & Keller E *Student Review Guide to Accompany Environmental Science: Earth as a Living Planet* 5ed (2005) 279 – 80.

¹³⁴ Jarman M *Climate Change* (2007) 5.

¹³⁵ Prof Hammes PS, Prof Reinhardt CF & Dr Webb EC 'Agricultural perspectives III – impact of agriculture on the environment' available at http://myfundi.co.za/e/Agricultural_perspectives_III_%E2%80%93_Impact_of_agriculture_on_the_environment [accessed on 17/04/2012].

¹³⁶ Rahlao S 'SA National REDD + initiative' (2010) 6 available at http://cap.org.za/workshop_03/day_1_session_1/Seb_SA%20National%20REDD%20Initiative.pdf [accessed on 19/04/2012].

¹³⁷ Collins J 'Deforestation' (2001) available at <http://www.bcb.uwc.ac.za/envfacts/facts/deforestation.htm> [accessed on 20/04/2012].

¹³⁸ Greenpeace 'Deforestation and climate change' available at <http://www.greenpeace.org.uk/forests/climate-change> [accessed on 25/04/2012].

Indeed, deforestation for agricultural purposes, especially by burning, is a great danger to climate change. South Africa as a developing economy finds it difficult to stop deforestation due to the fact that people must survive; in other words, forests are cleared so that the area can be used for agricultural purposes to sustain the growing population, but also to keep market supplies stable.¹³⁹ In South Africa hectares of forest have been cut down for agricultural purposes. Available statistics indicate that South African's entire deforestation rate between 2005-2010 stood at 0.15%, lower than the 2000-2005 rate which was 0.30%,¹⁴⁰ without specifying agriculture's contribution. The South African National Forest Act 84 of 1998 clearly states that forests require particular protection, thus disallowing deforestation, and gives the minister in charge of the forestry portfolio the powers to intervene where necessary to avert deforestation or rehabilitate areas where forests have been destroyed.¹⁴¹ From the deforestation rates mentioned above, it is obvious that the Act has only been effective to an extent. Thus, in one way or another deforestation for farming in South Africa must have favoured the actual global warming that challenges the globe today.

Within NAFTA, the story is not very different, due to the fact that there agricultural activities equally have an impact on climate change. Since 1994, the beginning of NAFTA, a number of strong trade negotiations during several bilateral and regional trade agreements have put on the table regulations addressing environmental concerns, amongst which deforestation and climate change. This is a strong sign that regional norms as well as the WTO requirements regarding prevention of deforestation are not neglected. However, the region's environmental history is not spotless, and deforestation is one of the region's greatest environmental challenges as a result of massive farming and ranching. The destruction and burning of forests especially in Mexico contribute seriously to the emission of GHG into the atmosphere.¹⁴²

In the EU, global warming is also taken very seriously. Thus, in compliance with the Union's regulations regarding the enforcement of environmental protection the EU has taken several steps to limit, if not to put an end to, global warming through limitation of deforestation and its

¹³⁹ Scribd 'The issue's of deforestation in Southern Africa' available at <http://www.scribd.com/doc/7502789/The-Issues-of-Deforestation-in-Southern-Africa> [accessed on 24/04/2012].

¹⁴⁰ Mongabay.com 'South Africa forest information and data' available at http://rainforests.mongabay.com/deforestation/2000/South_Africa.htm [accessed on 27/04/2012].

¹⁴¹ National Forest Act 84 of 1998, Part 4.

¹⁴² COHA 'NAFTA, CAFTA-DR, and the role of the environment' (2006) available at http://williambowles.info/americas/coha_nafta.html [accessed on 27/04/2012].

consequences. The EU is even believed to be the leader in global climate policy and is the most compliant as regards the reduction of GHG.¹⁴³ The EU, however, to an extent still has a long way to go as hectares of forest are still dedicated for farming purposes, most of the forest is burnt and that seriously increases the emission of GHG into the atmosphere¹⁴⁴ This also indicates that agricultural trade in the EU weighs on the environment, and is the reason why deforestation is still a common practice even though the Union's environmental regulations and the WTO rules on environmental protection clearly state the steps to be taken in order to keep the environment safer.¹⁴⁵

Owing to the fact that deforestation is not the only consequence of agricultural trade that can affect climate change, the next subsection will focus on analysing the actual effects of farming itself.

3.4.2 Farming

Farming, as mentioned earlier, presents considerable advantages for the environment as a whole, and climate change in particular. However, where regulations available for environmental protection are not properly enforced, it can also produce serious adverse and unintended effects on both the environment and climate change.

Farming in South Africa, as well as in the NAFTA or in the EU, has the potential to cause several adverse and unintended effects on climate change. Some animals, like sheep and cattle, are said to produce an important amount of methane:

'Methane (CH₄) is a greenhouse gas that remains in the atmosphere for approximately 9-15 years. Methane is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide (CO₂) over a 100-year period and is emitted from a variety of

¹⁴³ Bosetti V & Lubowski RN *Deforestation and Climate Change: Reducing Carbon Emissions from Deforestation and Forest Degradation* (2010) 39 (hereafter Bosetti V & Lubowski RN (2010)).

¹⁴⁴ Bosetti V & Lubowski RN (2010) 138.

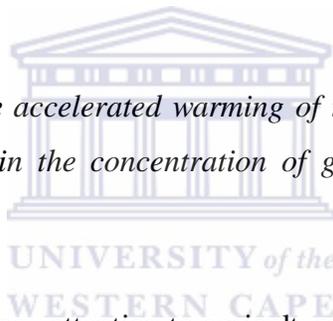
¹⁴⁵ Barnett P 'The effects of deforestation' (2008) available at <http://www.helium.com/items/849747-the-effects-of-deforestation> [accessed on 13/11/2012].

*natural and human-influenced sources. Human-influenced sources include landfills, natural gas and petroleum systems, agricultural activities,*¹⁴⁶

Some fertilizers highly used on farms in South Africa, although not as much as in NAFTA and EU, with the aim to improve the agricultural harvest, also release into the atmosphere nitrous acid which is also a GHG.¹⁴⁷

This shows that the enforcement of laws put in place by South Africa such as the National Environmental Management Act 107 of 1998, also NAFTA and the EU in complying with the WTO and other international norms dealing with climate change have been successful, but only to an extent. Thus, human activities (and agricultural trade in particular) are a contributing factor to global warming, that requires stronger enforcement of the law to be successfully dealt with, as:

*'It is beyond doubt that the accelerated warming of the last fifty years has been caused primarily by the increase in the concentration of greenhouse gas and is hence man-made'*¹⁴⁸



It is very important at this point to pay attention to agricultural impacts on land in particular, as it is a matter of great interest.

¹⁴⁶ US Environmental Protection Agency 'Methane' (2011) available at <http://www.epa.gov/methane/> [accessed on 27/04/2012].

¹⁴⁷ WWF 'What causes global warming?' available at http://www.wwf.org.au/our_work/people_and_the_environment/global_warming_and_climate_change/science/global_warming_causes/ [accessed on 27/04/2012].

¹⁴⁸ Stocker T 'Earth in the greenhouse – a challenge for the twenty-first century' in Cottier T, Nartova O & Bigdeli SZ (eds) *International Trade Regulation and the Mitigation of Climate Change: World Trade Forum* (2009) 4

3.5 South African Farmland: Environmental Impacts

Land specifically used for farming in the raising of crops or livestock is vital for the success of agriculture in a given country or region. The survival of humans and other living organs, like plants and animals, depends to an extent on the outcome of agricultural trade.¹⁴⁹ Considering the important impacts that agriculture can have on the environment, a serious need arises for countries like South Africa to enforce environmental protection through national legislation and regulations, including the Bill of Rights incorporated in the South African Constitution Act 108 of 1996 and the Environment Conservation Act 73 of 1989. The EU's Common Agricultural Policy (CAP) is not indifferent to environmental concerns resulting from the agricultural sector, and in the NAFTA region member states have joined forces to pursue a similar goal. The main purpose of the different efforts on the part of either South Africa, the EU or NAFTA is to make sure that the negative impacts of agricultural trade are outweighed by the positive ones, and where necessary to limit the adverse effects as much as possible. As it will set out in greater detail below, this research finds that South Africa's efforts in enforcing environmental norms have only produced mixed results, and that the case is not very different for NAFTA and the EU. Several agricultural activities still raise doubts as to what extent environmental norms are really being enforced and complied with. More light will be shed on this as the research analyses intensive farming, irrigation and soil degradation as farming activities that pose a serious threat to the environment.

3.5.1 Intensive Farming

The repeated use of the same area for farming, also known as intensive farming, has serious impacts on the environment. Intensive farming is a farming method that seeks to get maximum yield from accessible land. This farming method may be appropriate for the rearing of livestock also. One could say that through the use of intensive farming, crops are grown in huge amounts

¹⁴⁹ Clay JW (2004) viii.

with the help of chemical fertilizers and pesticides that are used appropriately to save such farming yield from pests and crop diseases brought on by them.¹⁵⁰

‘Agriculture is the foundation of developing economies. As one of these economies, South Africa needs to ensure a healthy agricultural industry that contributes to the country’s gross domestic product (GDP), food security, social welfare, job creation and ecotourism, while adding value to raw materials. But the health of the agricultural sector depends on the sustainability of farming methods. Farming practices must therefore not only protect the long-term productivity of the land, but must also ensure profitable yields and the well-being of farmers and farm workers.’¹⁵¹

In South Africa climate-soil combinations allow only 12% of the country to be appropriate for the production of rain-fed crops, and just 3% of the land is said to be fertile. Most of South Africa’s land surface, which is estimated at about 69%, is said to be suitable only for grazing; this explains why livestock is by far the largest farming sector.¹⁵² The limited land area available for farming might explain why intensive farming is a serious issue. Moreover, poorly managed intensive farming can affect the natural environment, people’s wellbeing, and even the farmer’s ability to adapt to change in South Africa, and produces the adverse and unintended impacts that we can witness today.¹⁵³ Some of these impacts are now detailed.

Soil fertility in the long term is seriously affected and reduced by the dependence and overuse of synthetic fertilizers, pesticides and herbicides. Intensive farming requires repeated use of particular land for an extensive period of time, which, first of all, demands constant use of synthetic fertilizers to improve the fertility of the soil, and, then, repeated use of pesticides and herbicides mainly to maintain the quality of the crops grown on the farm. The end result of the

¹⁵⁰ Pillai M ‘Advantages and disadvantages of intensive farming’ (2011) available at <http://www.buzzle.com/articles/advantages-and-disadvantages-for-intensive-farming.html> [accessed on 28/04/2012] (hereafter Pillai M (2011)).

¹⁵¹ Dr. Goldblatt A ‘Agriculture: Facts and trends South Africa’ (2010) 2 available at <http://www.climatefruitandwine.co.za/download/WWF.Agric.FactsheetJune.10.pdf> [accessed on 28/04/2012] (hereafter Dr. Goldblatt A (2010)).

¹⁵² Dr. Goldblatt A (2010) 2

¹⁵³ Tredoux G & Talma AS ‘Nitrate pollution of groundwater in southern Africa’ in Xu Y & Usher B (eds) *Ground Water Pollution in Africa* (2006) 19. (hereafter Tredoux G & Talma AS in Xu Y & Usher B (eds) (2006))

extensive use of such chemicals is adverse effects on the soil and underground water.¹⁵⁴ Although such effects are unintended, they contribute to degrading and polluting the soil. This will be examined in detail when soil degradation and soil pollution are discussed below.

Over-reliance on the above-mentioned chemicals also leads to soil pollution, poisoning of fragile ecosystems, and exposes farmers and farm employees to dangerous and unhealthy products, such as, chemicals amongst which pesticides and insecticides. Furthermore as mentioned above, the repeated use of such chemicals as a consequence of intensive farming, contributes to climate change by considerably increasing the amount of GHGs that are released into the atmosphere.¹⁵⁵

The above is a clear indication that South Africa still has many challenges as far as environmental protection is concerned, especially regarding the consequences of intensive farming which is a common practice in the country. Intensive farming is, however, not a practice only in South Africa; the NAFTA and EU regions are equally concerned.

In the NAFTA region, intensive farming is well represented. It is even more intensive in a country like the US due to the fact that the US is more developed and advanced as regards agriculture.¹⁵⁶ One reason behind such a high rate of intensive farming is the fact that most of the US arable land is quite vast. On the other hand, in countries like Mexico which have several steep and mountainous landscapes, intensive farming is practised less.¹⁵⁷ Nonetheless, it is worth acknowledging that intensive farming in that country equally has serious negative effects on the environment although not as extensively as in the US. It is appropriate to say that the adverse effects of intensive farming in NAFTA vary from one country to another; in other words, they are much greater in certain member countries, like the US and Canada, as compared to Mexico.¹⁵⁸ Just like in South Africa, intensive farming in this region seriously affects soil quality and the life and health of farm owners and farm workers.

In the EU intensive farming is not usual, but as in the NAFTA region the degree of intensive farming varies from country to country:

¹⁵⁴ Tredoux G & Talma AS in Xu Y & Usher B (eds) (2006) 19.

¹⁵⁵ Dr. Goldblatt A (2010) 2-3.

¹⁵⁶ Zahniser S & Link J 'NAFTA, agriculture trade, and the environment' (2002) 44 available at <http://www.ers.usda.gov/publications/wrs0201/wrs0201f.pdf> [accessed on 29/04/2012] (hereafter Zahniser S & Link J (2002)).

¹⁵⁷ Zahniser S & Link J (2002) 44.

¹⁵⁸ Henriques G & Patel R 'NAFTA, Corn, and Mexico's agricultural trade liberalization' (2004) 3 available at <http://dspace.cigilibrary.org/jspui/bitstream/123456789/113/1/NAFTA%20Corn%20and%20Mexicos%20Agricultural%20Trade%20Liberalization.pdf?1> [accessed on 29/04/2012].

'- Intensive agriculture attributes mainly to South of Europe, particularly to Mediterranean region. Outside this region land areas taken by intensive agriculture in most cases are insignificant.

- Considerable increase in proportion of agricultural land farmed intensively can be recorded only in Spain, Portugal and Greece. In other countries this dynamics is negligible and areas of intensive agriculture even tend to decrease.

- Concentration of intensive agriculture in coastal zone is recorded only in Spain. Intensive agriculture does not substantially affect coastal sustainability in the rest of the project partner countries.¹⁵⁹

It is worth mentioning here that intensive farming in the EU region, whether more or less extensive, nonetheless produces adverse effects on the environment. Such effects do not differ from those occurring in South Africa and the NAFTA; in certain areas they are even more serious when compared to the situation in South Africa due to the fact that farming in the EU, just as in the NAFTA region, is more extensive than in South Africa. Consequently pesticides are used extensively and this is assumed to have provoked an increased in the number of cancer patients after they consumed inorganic vegetables, fruits, poultry and meat obtained from intensive farming sites.¹⁶⁰

Intensive farming, as seen above, affects soil fertility, implying that the soil quality or the nature of the soil certainly will never be the same again. However, it is not the only farming method that adversely affects the environment. The next subsection aims to analyse irrigation to establish what happens to the soil when such agricultural activity fails to apply what the regulation require to keep the environment safer.

¹⁵⁹ Deduce 'Land take by intensive agriculture' (2011) 1 available at <http://www.deduce.eu/IFS/IFS06.pdf> [accessed on 30/04/2012].

¹⁶⁰ Pillai M (2011)

3.5.2 Irrigation

When farmland is too dry for crops to grow, an alternative option could be to wait for the rainy season. But today with the fast growing market and increased demand for food, requiring increase in the supply of food for the world's growing population, farmers cannot always rely on wet or rainy seasons. Another alternative would be to utilise irrigation, in order to farm the lands and maintain the food supply in all seasons. "Irrigation" can be defined as a process comprising artificial provision of water to the soil for the growth of agricultural crops. In other words, it is a science of planning and designing a water provision method for the farmland to protect the farm produce from the negative effects of drought or low rainfall, by constructing weirs, dams, barrages and canal systems for continual provision of water to the cultivable lands.¹⁶¹

Records show that as early as 1921 irrigation was identified as an unavoidable practice to improve agriculture produce in the then Union of South Africa. At that time it was estimated that half a million acres of the land surface were actually irrigated.¹⁶²

Today the Republic of South Africa occupies a land surface of 122 million hectares of which 18 million hectares are probably farmland, and 8% of the probable arable land is believed to be under irrigation. This uses almost half of the water requirements of the whole of South Africa.¹⁶³

Irrigation in South Africa helps to improve crop yields, and is worth being considered a positive method, especially when it is applied with respect for environmental norms. It is nonetheless important to acknowledge the risk it bears for the environment. Irrigation can sometimes be very destructive in areas like Mpumalanga, where water drained from mines is used to supplement the scarce water resource; the water usually contains the geological properties of coal, gold ore and other geological materials.¹⁶⁴ Even though, for the environment's sake, the water is usually treated, it still poses some environmental concerns, such as, possible nutritional problems like deficiencies in K, Mg and NO₃ caused by Ca and SO₄. Soil salinity is also said to increase when

¹⁶¹ Basak NN *Irrigation Engineering* (1999) 1.

¹⁶² Forde CD 'Irrigation in South Africa' (1925) 65 *The Geographical Journal* 342

¹⁶³ Dennis JH & Nell WT 'Precision irrigation in South Africa' (2002) 1 available at <http://ageconsearch.umn.edu/bitstream/7023/4/cp02de01.pdf> [Accessed on 30/04/2012].

¹⁶⁴ Jovanovic NZ, Annandale JG, van der Westhuizen AM & Steyn JM 'Monitoring the effect of irrigation with gypsiferous mine wastewater on crop production potential as affected by soil water and salt balance' (2004) 2 *The Journal of The South African Institute of Mining and Metallurgy* 73 (hereafter Jovanovic NZ et al (2004)).

such water is used, and even if this can fluctuate, it is necessary to admit that it is a potential risk for the environment.¹⁶⁵

Another instance concerning the impact of irrigation is what happened along the Lower Vaal River where semi-arid soils were accessed. Test results showed that the salinity level of the irrigated land was higher, compared to the adjacent virgin soil. It is also reported that in another part of the same region, in an area known as Vallharts, the maximum underground salt increase was above the salt level contained in the water, which is not healthy for the growth of certain plants or crop species.¹⁶⁶ In the light of the above examples it is difficult to agree that South Africa's efforts in enforcing environmental norms have been a total success.

In NAFTA, farmland is not spared irrigation practices, due to the fact that in certain areas, just as in South Africa, water is scarce, and during certain seasons arable land is too dry to grow crops without extra water being added to the soil through artificial means; that is irrigation. The unfortunate thing is that the NAFTA environmental impacts are said to have been relatively negative in the agricultural sector, particularly in instances where unintended effects of irrigation on the ecosystem have been recorded,¹⁶⁷ for instance, in parts of US water evaporation increased as a result of irrigation leaving the ground more dry than usual.¹⁶⁸

The EU is not an exception to the practice of irrigation, but efforts are being made to control its effects. For instance, efforts are being made to examine the effects of irrigation on local economies and biodiversities in the south-eastern region of Turkey which appears to be one of the most affected areas in the Union. This is certainly aimed at understanding where environmental protection needs to be enforced.¹⁶⁹ In southern Europe water used for irrigation accounts for more than 60% of water use in most countries, while in the north the maximum water use is about 30%, and in certain countries irrigation is very insignificant.¹⁷⁰ However, the

¹⁶⁵ Jovanovic NZ et al (2004) 73.

¹⁶⁶ Le Roux P, du Preez CC, Strydom MG, van Rensburg LD & Bennie ATP 'Effect of irrigation on soil salinity profiles along the lower Vaal River, South Africa' (2007) 33 *Water SA* 473.

¹⁶⁷ King A *Ten Years with NAFTA: A Review of the Literature and an Analysis of Farmer Responses in Sonora and Veracruz, Mexico* (2006) 14 (hereafter King A (2006)).

¹⁶⁸ Ozdogan M, Rodell M, Beaudoin HK & Toll DL 'Simulating the effects of irrigation over the United States in a land surface model based on satellite-derived agricultural data' (2010) 11 *Journal of Hydrometeorology* 178

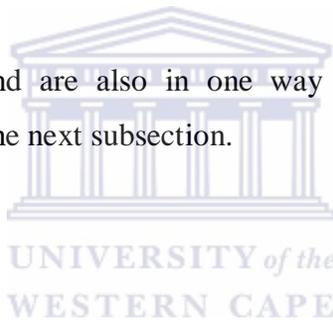
¹⁶⁹ Flint CR *The Geography of War and Peace: From Death Camps to Diplomats* (2005) 267.

¹⁷⁰ Baldock D, Caraveli H, Dwyver J, Peterson JE, Sumpsi-Vinas J & Varela-Ortega C 'The environmental impacts of irrigation in the European Union' (2000) I available at <http://ec.europa.eu/environment/agriculture/pdf/irrigation.pdf> [accessed on 05/05/2012] (hereafter Baldock et al (2000)).

present discussion is more interested in those areas where the practice of irrigation is at a high level. In certain parts of Europe water used for irrigation is transported from surface sources, which present less or no threat to the soil. But in other areas of Europe the most used method is irrigation by sprinklers with the aid of pressure, which in most cases draws water from subterranean aquifers. Such practice presents a potential risk for the environment, because water from aquifers is at times contaminated with nitrate.¹⁷¹ And nitrate itself is quite threatening to humans and animals as it can cause cancer in the digestive system and inflammable bowel diseases.¹⁷²

Unlike South Africa and NAFTA, in the EU irrigation systems are controlled with the aim to build water supply infrastructures that will not only make possible water availability for irrigation purposes, but will also limit as much as possible the potential negative impacts of irrigation on the environment.¹⁷³ It is quite clear that the enforcement of environmental protection is more evident here.

The effects of agriculture on land are also in one way or the other connected with soil degradation which is the focus of the next subsection.



3.5.3 Soil Degradation

"Soil degradation" is defined as deterioration in the soil quality, its topsoil, vegetation or water resources generally, as a result of excessive or improper utilisation.¹⁷⁴ It is also known as "desertification", which simply means destruction of arable land in dry areas as a result of poor use or over-use.¹⁷⁵ With agricultural trade becoming more extensive over the years, soil degradation is seriously on the increase globally:

¹⁷¹ Baldock D et al (2000) i, 40.

¹⁷² D Powlson DS, Addiscott TM, Benjamin N, Cassman KG & de Kok TM 'When does nitrate become a risk for humans?' (2008) 293, available at <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1102&context=agronomyfacpub> [accessed on 05/05/2012].

¹⁷³ Molle F & Berkoff J 'Water pricing in irrigation: The lifetime of an idea' in Molle F & Berkoff J (eds) *Irrigation Water Pricing: The Gap Between Theory and Practice* (2007) 1.

¹⁷⁴ Zdruli P, Kapur S, Pagliai M & Cano AF 'What we know about the saga of land degradation and how to deal with it' in Zdruli P, Kapur S, Pagliai M & Cano AF (eds) *Land Degradation and Desertification: Assessment, Mitigation and Remediation* (2010) 8-9

¹⁷⁵ Environmental Monitoring Group 'Soil degradation' available at <http://www.bcb.uwc.ac.za/inforeep/land1.htm> [accessed on 05/05/2012] (hereafter Environmental Monitoring Group).

*'Mismanagement of arable areas by farmers and grazing areas by livestock owners is one of the major causes of soil degradation'*¹⁷⁶

This is enough reason for this research to examine the extent to which South Africa, the NAFTA and the EU have considered soil degradation as a threat to a sustainable environment, and the efforts that are being made by them in accordance with the requirements of WTO and other environmental enforceable regulations to curb or at least limit its impacts.

In South Africa soil degradation results from several causes, which vary from intensive farming and irrigation to deforestation. Combined with other factors or as result of a chain of events, it can be devastating to the environment at times. A survey indicates that 25% of South Africa's magisterial districts are severely degraded, and that one of the known causes is intensive farming.¹⁷⁷

The extensive use of land for growing crops or for animal grazing has seriously damaged the soil quality in South Africa.¹⁷⁸ Soil degradation is also accelerated by chemicals, such as synthetic fertilizers used on farmlands.

The severe soil degradation today in South Africa is also caused by irrigation. Although it is only intended to supply water to dry land in order to help make the land productive, the end result in certain cases is disastrous for the soil which in many cases is severely degraded when its salinity is increased in the process.¹⁷⁹ One clear example is that of the Lower Vaal River irrigation, discussed above where the soil quality was negatively affected as soil salinity increased.

Another agricultural consequence that has the potential of influencing the nature of the soil through degradation is deforestation. It is usually carried out in the agricultural sector as a result of the permanent need for land to grow crops or graze livestock. Its unintended effect is that it contributes either directly or indirectly to soil degradation. Its direct negative impact is the destruction of biodiversity: extinguishing certain plant species and at the same time making it impossible for certain plants to grow as they can only grow in forests. Furthermore, it destroys

¹⁷⁶ Ballayan D 'Soil degradation' (2000) 1 available at <http://www.unescap.org/stat/envstat/stwes-04.pdf> [accessed on 05/05/2012].

¹⁷⁷ Environmental Monitoring Group.

¹⁷⁸ Environmental Monitoring Group.

¹⁷⁹ Rietz DN & Haynes RJ 'Effects of irrigation-induced salinity and sodicity on soil microbial activity' (2003) 35 *Soil Biology and Biochemistry* 845.

the habitat for species of animals as well.¹⁸⁰ Moreover, in certain areas where it is exposed to the sun, the soil is likely to become dry and be transformed into desert, simply because of a lack of or insufficient moisture, and its inability to retain moisture. Sometimes even before that takes place, dust storms might become very recurrent, rendering the soil useless. The main indirect negative effect of deforestation is soil erosion. Because of deforestation rainfall run-off is likely to intensify soil erosion, although this depends on the topography and characteristics of a particular area. Also, the clean water that usually runs from forests is likely to either disappear or reduce seriously as a consequence of deforestation. South Africa's topsoil loss per year is estimated at about 300 – 400 million tonnes.¹⁸¹ There is no doubt that the South African government is making efforts to put in place environmental norms, capable to avoid soil degradation by passing laws such as the Pesticide Management Policy. However, from the facts stated above, it is also clear that the enforcement of such laws is not very effective.

In the NAFTA region, steps are being taken to keep the environment safer, yet soil degradation is a very serious issue, and its causes in the agricultural sector are the same as those in South Africa. A remarkable thing in this region is the fact that capital intensive corn production affects the environment adversely: in particular it causes soil erosion. Mexico is said to be the most affected as soil erosion is a great problem there.¹⁸²

Soil degradation occurs in the EU too. The six identifiable causes of soil degradation closely linked to agriculture are: erosion, decrease of soil organic carbon, salinisation and solidification, compaction, defects in and diminishing of soil biodiversity.¹⁸³ However, in the EU environmental protection in general and particularly, soil degradation resulting from agricultural activities is given a proper attention:

'In 2007, the European Parliament requested the European Commission to carry out a pilot project on 'Sustainable Agriculture and Soil Conservation through simplified cultivation techniques' (SoCo). The European Parliament considered that 'in Europe, soil

¹⁸⁰ Sivashanmugam P *Basic Environmental Science and Engineering* (2007)7, 45-6 (hereafter Sivashanmugam P (2007)).

¹⁸¹ Sivashanmugam P (2007) 7, 8, 46.

¹⁸² Organisation for Economic Co-Operation and Development *Assessing the Environmental Effects of Trade Liberalisation Agreements Methodologies* (2000) 74.

¹⁸³ SoCo Project Team 'Addressing soil degradation in EU agriculture: Relevant processes, practices and policies' (2009) v available at http://eusoils.jrc.ec.europa.eu/esdb_archive/eusoils_docs/other/EUR23767.pdf [accessed on 10/05/2012] (hereafter SoCo Project Team (2009)).

degradation and erosion is probably the most significant environmental problem' and underlines the importance of conservation agriculture as being a 'set of soil management practices which minimise alteration of the composition, structure and biodiversity of the soil, safeguarding it against erosion and degradation'.¹⁸⁴

This shows that the enforcement of environmental norms is effective to a certain extent in the EU. Having determined how agriculture can affect our environment, particularly the soil quality, this research also seeks to establish agricultural trade's responsibility for environmental pollution and its indirect effects on human health.

3.6 The Polluting Effects of Agriculture on the Ecosystem

It has been identified in this research that agriculture means a lot to a country's economy, particularly in terms of poverty alleviation, via its contribution to the GDP, job creation and food provision, to name just a few. This section's aim is to further establish and/or confirm that the impacts of agriculture on the environment are quite mixed. Beside the above analysed negative effects of agriculture on the ecosystem, this research has found that pollution is one major adverse effect of agriculture. Although, pollution might in some way be connected to other discussed effects, such as, deforestation, irrigation, and waste management, it is nonetheless worth being analysed again, separately and more deeply as it is very critical. This is due to the fact that it represents a potential risk or threat to human health.¹⁸⁵ The issue of environmental pollution by agricultural activities and its consequences for human health will be analysed from three perspectives; air, soil and water.

¹⁸⁴ SoCo Project Team (2009) IV.

¹⁸⁵ Schaper M, Jofre J, Uys M & Grabow MOK 'Distribution of genotypes of F-specific RNA bacteriophages in human and non-human sources of faecal pollution in South Africa and Spain' (2002) 92 *Journal of Applied Microbiology* 658.

3.6.1 Air Pollution

"Air pollution" can be defined as the existence of particulates, harmful gases or other impurities in the air that have the potential to harm human or environmental health.¹⁸⁶ In other words, it is one of the most dangerous and permanent threats to the environment as a whole and human health in particular. South Africa brought into force the National Environment Management: Air Quality Act 39 of 2004;

*'...which reformed the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures.'*¹⁸⁷

It is unfortunate that agriculture still contributes to polluting the air that is vital for a safe ecosystem. In South Africa agriculture is believed to be the greatest contributor to methane emission (48% of the national total) and nitrous oxide emissions (78% also of the national total). These gases are not only constant threats to global warming, but also effective in polluting the air, thus putting human health at risk.¹⁸⁸ Air pollution can cause diseases such as asthma and lung cancer, to name just a few. In Polokwane, Limpopo province in the Republic of South Africa, a survey conducted of school children aged 13 to 14 showed that certain children had contracted asthma as a result of air pollution. The survey does not specify the degree to which agriculture contributed to pollute the air, but there is an indication that agriculture could also be the cause, as the survey indicates that some of the causes were smoke and other gases inhaled by the

¹⁸⁶ Agarwal SK *Air Pollution* (2009) 5.

¹⁸⁷ Department of Environmental Affairs and Tourism 'South Africa country report: Fourteenth session of the United Nations Commission on sustainable development' (2005) available at <http://www.un.org/esa/agenda21/natlinfo/countr/safrica/atmosphere.pdf> [accessed on 10/05/2012].

¹⁸⁸ Dr. Scholes RJ, van der Merve M, John J & Oosthuizen R 'State of the environment - South Africa: Climatic and atmospheric change' (1999) available at <http://www.ngo.grida.no/soesa/nsoer/issues/climate/index.htm> [accessed on 13/11/2012].

children.¹⁸⁹ A considerable amount of smoke and certain gases like those mentioned above go into the atmosphere when forests are cut and burnt, as well as during other farming activities. This leaves one with doubt as to the effectiveness of the multitude of environmental norms that South Africa has adhered to and those that it has enacted, such as the Atmospheric Pollution Prevention Act 45 of 1965.¹⁹⁰

In NAFTA, air pollution deriving from agricultural activities is also very serious and produces similar effects to those in South Africa. When compared to the US and Canada, Mexico is the most affected, as is the case with many environmental issues.¹⁹¹

Agricultural emissions in the EU are quite relevant to certain atmospheric transport related environmental concerns, including local and regional air quality problems, such as, PM exposure, eutrophication and acidification, toxins and contribution to GHG emissions, resulting in a considerable amount of environmental impacts. Agricultural emissions vary in space and time and their contribution to various issues are variable over Europe. Most important of gas emissions into the atmosphere are: ammonia (90%), PM (20%) and nitrous oxide and methane (both 5%). Such emissions are a potential threat to human health, plants and animals; for instance, PM can cause cardiovascular diseases. Fortunately policies have been developed to combat some of the emissions, and with success in some countries. However, it is necessary to continue striving to decrease such emissions and their related problems as the danger is still looming. Research is being carried out on issues like the atmosphere–biosphere exchange of ammonia, the quantification of landscape development, and the primary and secondary emissions of PM.¹⁹²

When agricultural activities take place, those chemicals and substances that cannot evaporate into the air, generally in certain cases, go into the soil, thus causing soil pollution.

¹⁸⁹ Maluleke KR & Worku Z 'Environmental determinants of asthma among school children aged 13-14 in and around Polokwane, Limpopo Province, South Africa' (2009) 6 *International Journal of Environmental Research and Public Health* 2354 - 5.

¹⁹⁰ As amended by the Atmospheric Pollution Prevention Act 55 of 1985.

¹⁹¹ Ghiso SJV 'NAFTA, Environment and Institutions: A Critical Analysis of the National and Multilateral Environmental Institutions in Mexico, In Light of Trade Liberalization in the Agricultural Sector' (2003) 2, 10 available at <http://www.cameronhepburn.com/VilasMScThesis.pdf> [accessed on 25/05/2012].

¹⁹² Erisman JW, Bleeker A, Hensen A & Vermeulen A 'Agricultural air quality in Europe and the future perspectives' (2008) 42 *Atmospheric Environment* 3210-12.

3.6.2 Soil Pollution

Soil pollution, also known as soil contamination,¹⁹³ is generally caused by the presence of xenobiotic chemicals or other alteration in the natural soil environment. Soil pollution is very much linked to soil degradation, in the sense that polluted soil also degrades, and then loses its fertility or productivity. Soil pollution is even more critical, as it has the potential to affect human health adversely. In South Africa where agriculture is intensely practised, especially with intensive farming necessitating high use of synthetic fertilizers and irrigation,¹⁹⁴ soil pollution is inevitable. In Northern KwaZulu-Natal 18% of fertiliser use is with regard to sugar cane.¹⁹⁵ Moreover, available data indicate that South Africa's overall domestic demand for fertiliser in 2006 was 760,000 tonnes:

*'Gauteng, Mpumalanga, Limpopo and North-West account for approximately 40% of total domestic fertiliser consumption, and the Free State, KwaZulu-Natal and the Western Cape for approximately 20% each.'*¹⁹⁶

In the NAFTA region, it is estimated that agriculture is the greatest contributor to environmental pollution, soil pollution being an example. Even though the US and Canada also practise extensive agriculture, once more Mexico, whose agriculture is not as extensive as theirs, is the most affected. This implies that the rate of soil pollution in Mexico is higher than in other member countries.¹⁹⁷ This equally indicates that human health is more at risk in Mexico than in other member countries.

The EU is no exception to soil pollution as an impact of agricultural trade. In the EU the agriculture sector makes use of a considerable quantity of fertilizers and pesticides which

¹⁹³ Beyer WN 'Evaluating soil contamination' (1990) *US Fish and Wild Life Service, Biological Report 90* (2) 1 available at http://www.nwrc.usgs.gov/wdb/pub/others/FWS_Bio_Rep_90-2.pdf [accessed on 27/05/2012].

¹⁹⁴ FAO 'Fertilizer use by crop in South Africa' (2005) 8, 10 available at <ftp://ftp.fao.org/agl/agll/docs/fertusesouthafrica.pdf> [accessed on 27/05/2012] (hereafter FAO (2005)).

¹⁹⁵ FAO (2005) 15.

¹⁹⁶ Van der Linde GJ & Pitse MA 'The South African fertiliser industry' (2006) 4, available at <http://www.fssa.org.za/medialib/Downloads/Home/Articles/THE%20SA%20FERTILISER%20INDUSTRY%20no%202%20Feb06%20AFA%20Conf%20fin.pdf> [accessed on 30/05/2012].

¹⁹⁷ King A (2006) 14.

produce unintended effects, consequently polluting the soil.¹⁹⁸ Such effects in turn put human life at risk: landslides such as the one that happened in Sarno, South Italy, in 1998 are attributed to poor soil quality caused by pollution.¹⁹⁹ However, a lot of effort is being made to enforce environmental protection aiming to curb soil pollution in the Union. Steps are being taken to plan soil utilisation, and to target sustainable use of soil resources, with the aim to protect the soil quality in the EU from degrading as a result of pollution.²⁰⁰ This shows the will of the EU to enforce norms, such as, the WTO environmental norms, certain environmental law regulations to which the EU is a party, and of course its own environmental regulations.

It is likely that agricultural activities causing soil pollution can provoke a chain reaction, in the sense that soil pollution has the serious potential to lead to water pollution which will be the focus of the topic that follows.

3.6.3 Water Pollution

When one talks of environmental concerns, water pollution is certainly one aspect that must be taken very seriously. It is very critical as it affects human health the most. Its consequences range from diseases in human and animals, plant life and the atmosphere. Its causes are mainly poor waste management, use on farms of chemicals, such as, fertilisers, insecticides and pesticides, and also irrigation.²⁰¹

South Africa is really exposed to water pollution resulting from farming, especially in remote or rural areas. Fortunately, measures are taken to limit water pollution, the main focus being to keep South Africa's water as safe as possible. For that purpose South Africa is a member of several bilateral and multilateral committees and commissions regarding water matters.²⁰² In addition,

¹⁹⁸ Gardi C, Menta C, Montanarella L & Cenci R 'Main threats on soil biodiversity: The case of agricultural activities impacts on soil microarthropods' in Toth G, Montanarella L & Rusco E (eds) 'Threat to soil quality in the European Union' (2008) *European Commission Joint Research Center Institute for Environment and Sustainability* 103 - 5.

¹⁹⁹ Wainwright J 'Weathering, soils, and slopes processes' in Woodward J (ed) *The Physical Geography of the Mediterranean* (2009) 179.

²⁰⁰ Toth G 'Soil quality in the European Union' in Toth G, Montanarella L & Rusco E (eds) 'Threat to soil quality in the European Union' (2008) *European Commission Joint Research Center Institute for Environment and Sustainability* 11.

²⁰¹ Environmental Pollution Centre 'Water pollution causes' available at <http://www.environmentalpollutioncenters.org/water/causes/> [accessed on 13/11/2012].

²⁰² See the National Water Resource Strategy (2004).

the South African Minister of Agriculture has been granted the powers to prescribe measures that with which all land users, especially farmers, must comply.²⁰³ However, when one looks at the alarming level and effects of polluted water in South Africa, serious doubts are raised as to whether the different environmental norms and those committees and commissions actually have any significant effect in this country.

*'South Africa has such dangerously polluted surface water that many thousands are routinely falling ill and dying of water-borne diseases such as cholera.'*²⁰⁴

Irrigation has been identified as negatively affecting rivers and underground water quality in South Africa, especially when it affects the salinity and sodicity of the soil. For instance, farming with sugar cane, which is one of the most irrigated crops along the Crocodile, Komati-Lomati and Pongolo River's catchments, is a potential threat as these rivers are transboundary. They cross into Swaziland and Mozambique.²⁰⁵ In Mthlathuze, a rural area in northern Kwazulu-Natal, where agriculture is generally practised, a high concentration of faecal coliform was noticed in the Mthlathuze water station. In this community 63% of the people's primary water sources are dams, rivers and streams. Here the probable risk of a water-borne disease outbreak is real.²⁰⁶ Also, the use of fertilizers and pesticides on farms sometimes result in water pollution, once more putting human health at risk.²⁰⁷ Another example, this time from the Western Cape: a study carried out in Grabouw, Hex River and Piketberg showed water contamination with endosulfan. The study indicated the contamination level of surface water to be 47% and of ground water to be 32%.²⁰⁸

²⁰³ Kidd M *Environmental Law* (2008) 118.

²⁰⁴ Censorbugbear 'Dangerous Water Pollution in South Africa' (2009) available at <http://censorbugbear-reports.blogspot.com/2009/03/south-africa-claims-water-is-basic.html> [accessed on 07/06/2012].

²⁰⁵ Van der Laan, Van Antwerpen & Bristow KL 'River water quality in the northern sugarcane-producing regions of South Africa and implications for irrigation: A scoping study' (2012) 38 *Water SA* 88.

²⁰⁶ Lin J, Biyela PT, Puckree T & Bezuidenhout CC 'A study of the water quality of the Mhlathuze River, KwaZulu-Natal (RSA): Microbial and Physico-chemical factors' (2004) 30 *Water SA* 17.

²⁰⁷ Agarwal SK *Water Pollution* (2005) 154.

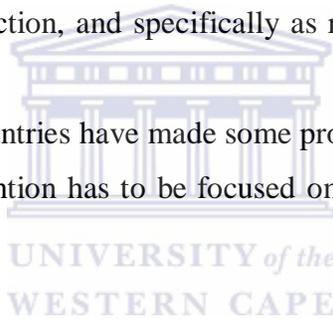
²⁰⁸ Dalvie MA, Cairncross E, Solomon A & London L 'Contamination of rural surface and ground water by endosulfan in farming areas of the Western Cape, South Africa' (2003) 1 available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC153526/pdf/1476-069X-2-1.pdf> [accessed on 20/06/2012] (Dalvie MA et al (2003)).

*'As water pollution by pesticides can affect many biological systems, the widespread use of potentially harmful pesticides has recently come under scrutiny in South Africa. Once contaminated, the groundwater may take a long time to clear and there is always the danger of bioaccumulation.'*²⁰⁹

There are strong signs that water and human health are at risk in South Africa, particularly in rural areas.

In the NAFTA region water pollution is also quite threatening, even though it is estimated that the northern American region has the best water quality worldwide. The common water pollutants in the region, including coliform bacteria, generally originate from farming with livestock. The region nonetheless has strong regulation in place, like the Federal Water Pollution Control Act which seeks to ensure water quality and safety, but the constant threat clearly indicates that environmental protection, and specifically as regards water safety, requires some more enforcement.²¹⁰

Over the years the EU member countries have made some progress in controlling water pollution in homes and industries; now attention has to be focused on reducing water pollution resulting from agriculture.



'Agricultural water pollution is becoming a major concern not only in developed regions such as the European Union (EU) but also in many developing countries. The intensification of agricultural practices—in particular, the growing use of fertilizers and pesticides, and the specialization and concentration of crop and livestock production—has had an increasing impact on water quality. The main agricultural water pollutants are nitrates, phosphorus, and pesticides. Rising nitrate concentrations threaten the quality of drinking water, while high pesticide use contributes substantially to indirect emissions of toxic substances. Increasing levels of nitrates and phosphorus in surface

²⁰⁹ Dalvie MA et al (2003) 1.

²¹⁰ Khakee F 'The North American Free Trade Agreement: The need to protect transboundary water resources' (1992) 6 *Fordham International Law Journal* 850, 856.

*waters reduce their ability to support plant and animal life and make them less attractive for recreation.*²¹¹

There is no doubt that the EU faces similar challenges from water pollution, but is making greater efforts to tackle issues.

3.7 Conclusion

Agricultural trade is a sector which is of great significance to governments and peoples. In South Africa, just as in NAFTA and in the EU, agricultural activities are inevitable, in view of its importance and contributions to achieving a sustainable development. For instance, agriculture contributes towards a country's GDP and continuous food supply, which is further supported by the achievements of GE. The facts as analysed in the present chapter clearly indicate that such development and satisfaction is to an extent achieved at the expense of a sustainable environment. This requires the putting in place of vital and enforceable rules or norms capable of affording potential environmental protection. These same rules require some degree of enforcement and application, without which they will remain less effective or completely ineffective. The analysis undertaken above shows that laws exist and are enforced at national, regional and international levels, but the main issue is the extent to which the laws are enforced or are effective. Considering the environmental impacts of agricultural trade in South Africa and elsewhere, it seems reasonable to conclude that agriculture trade, while trying to have a positive impact on international trade as expected by the WTO, has in some ways failed to comply with the requirements of the WTO SPS and AoA, and South African, NAFTA and EU legislation to safeguard the environment. It is also worth to mention that some norms are just not effective enough, like the SPS that allows member countries of the WTO to ban a particular product without any scientific proof of any potential danger. This is an indication that more needs to be done to enforce environmental protection, including unforeseen effects like those that may arise from GM crops. It is also evident that, unlike in South Africa, environmental protection in the EU is sounder, probably thanks to its higher economic development, but also as a result of better

²¹¹ Sheierling SM 'Overcoming agricultural water pollution in the European Union' (1996) 33 *Finance and Development* 32.

organisation. This could be a sign that environmental norms in South Africa concerning agriculture even those derived from the WTO need to be improved. Under recommendations, greater detail will be set out regarding what ought to be done, in order to better things.



CHAPTER FOUR

CONCLUSION AND RECOMMENDATIONS

This chapter deals with a concise summary of what has been analysed in the previous chapters. It concludes by presenting a number of recommendations for the enactment and implementation of laws capable of offering better protection to the environment in South Africa and elsewhere.

4.1 Conclusion

International Trade Law (ITL) is focused on the appropriate rules and customs for dealing with trade between countries, that is, international trade in both goods and services.²¹² In analysing agricultural trade, this research has established a pertinent link between trade and the environment.

It is obvious that ITL under the umbrella of the GATT and the WTO is not just concerned with the smooth running of international trade, but also with the manner in which it affects the environment, particularly the environmental impacts of agricultural trade. Considering the possible effects of agriculture on the environment, the WTO in attempting to keep the environment safer, has put in place necessary rules to guide the agriculture sector, while carrying on with trade in a profitable manner.²¹³ South Africa in compliance with ITL's requirements as far as environmental safety is concerned, has thus adhered to the WTO and other international norms, in addition to which, it has laws on environmental protection. It is obvious from the findings of this research that agricultural trade in South Africa is not as environmentally friendly as one would expect, because it has resulted in a mixed blessing for South Africa.

On the one hand, the agriculture sector boosts the economy of the country by: contributing to its GDP, being a source of income to investors, employing thousands and feeding millions, thus contributing towards poverty alleviation and profitable trade.²¹⁴ On the other hand, it

²¹² Carr I *International Trade Law* 4 ed (2010) xciii.

²¹³ WTO 'Understanding the WTO' (2012) available at http://wto.org/english/thewto_e/what_is_e/what_stand_for_e.htm [accessed on 26/10/2012].

²¹⁴ WTO News 'Free trade helps reduce poverty, says new WTO secretariat study' (2000) available at http://www.wto.org/english/news_e/pres00_e/pr181_e.htm [accessed on 20/06/2012].

undoubtedly represents a potential threat to the environment. This research has analysed agriculture's contribution to global warming as a result of deforestation, as well as soil degradation, soil, air and water pollution, and the threat to human health resulting from extensive farming and the use of synthetic fertilisers and pesticides, poor waste management and irrigation. This is enough to raise an alarm, as 16% of all deaths in South Africa are related to the state of the environment, with agriculture being one of the contributors.²¹⁵ There is also the issue of GMOs, which its promoters and initiators consider as an important development, which can only be beneficial to mankind.²¹⁶ But its critics are quite sceptical and strongly believe it represents a high risk to human health because GMO crops are not grown through conventional agricultural methods. Since there is no scientific proof of it being 100% sound or not, some serious precautions are worth being taken to make sure the environment is not at risk, or at least to diminish the chances of it being at risk.²¹⁷ In the face of all the challenges, one cannot doubt the fact that, the implementation of the international and regional regulations, and the national laws for environmental protection has only produced a mixed result, since agriculture still poses a serious threat to the environment.

For comparative purposes, the environmental impacts of agriculture in NAFTA and the EU have been analysed, and concludes that: the EU has a strong and better organised regulation of environmental protection, while NAFTA is the opposite, though member countries do at national level have some environmental regulations. However, it is obvious from the findings of this research that, both in the EU and the NAFTA, environmental challenges, such as: pollution (air, soil and water), soil degradation and global warming amongst others, are still quite threatening, and consequently require some firmer regulations to be dealt with.

This research finds it proper to conclude that, despite South Africa's efforts to implement environmental protection laws, agriculture still poses a serious challenge to the environment; this suggests that South Africa has to emulate the EU, and even do better. Above all, there is no doubt that the WTO's stand to protect the environment has not been able to achieve a remarkable

²¹⁵ CSIR 'The impact of an unhealthy environment on human health in South Africa' (2010) Briefing Note 2009/04 1 available at http://www.csir.co.za/nre/docs/Briefing%20Note%20No4%202010_environmental%20health_FINAL.pdf [accessed on 18/06/2012] (hereafter CSIR (2010)).

²¹⁶ Cloete TE, Nel LH & Theron J 'Biotechnology in South Africa' (2006) 24 *Trends in Biotechnology* 557.

²¹⁷ Moyo M, Bairu MW, Amoo SO & van Staden J 'Plant biotechnology in South Africa: Micropropagation research endeavours, prospects and challenges' (2011) 77 *South Africa Journal of Botany* 1003.

result in the South African agricultural sector. Below are some suggestions as to what should be done to improve environmental regulations regarding agricultural trade.

4.2 Recommendations

This research concludes that the efforts towards environmental protection within the agriculture sector, provided for in the GATT and the WTO texts, by South Africa, NAFTA and the EU require a boost. This section focuses on possible suggestions, regarding what should be done to render environmental regulations within the agricultural sector more effective, more specifically at an international level within the WTO and at a national level in South Africa.

The WTO texts need to be upgraded. In chapter two of this research, the analysis regarding the SPS measures indicates that, though its provisions relate to the environment, they do not particularly address agriculture's adverse effects on the environment. It is thus necessary that those measures clearly state such effects and advise countries on how to avoid them. It is also the same for the TBT, and of course the AoA, which simply request countries to ensure food safety and environmental protection, rather than precisely identifying the exact agricultural threats to the environment, and the steps to follow in order to better protect the environment within this sector. Environmental protection in South Africa might require a clearer WTO regulation regarding the agricultural sector. This research hopes that the current DOHA Round will successfully achieve that improvement. The DOHA Ministerial Declaration states that:

*'At the November 2001 Doha Ministerial Conference, the agriculture negotiations became part of the single undertaking.... We take note of the non-trade concerns reflected in the negotiating proposals submitted by Members and confirm that non-trade concerns will be taken into account in the negotiations as provided for in the Agreement on Agriculture.'*²¹⁸

South Africa is making efforts to enforce environmental protection norms, but the results so far indicate that more has to be done; there is need for firmer laws. Although, South Africa may not

²¹⁸ WTO 'Agriculture: Work in the WTO' available at http://wto.org/english/tratop_e/agric_e/negoti_e.htm [accessed on 16/06/2012].

possess the economic power of the EU, the EU Common Agricultural Policy (CAP) can be adopted as much as possible and even improved where necessary. The EU CAP, besides protecting farming throughout the Union by subsidising farmers in order to safeguard the countryside,²¹⁹ equally takes environmental protection in the agricultural sector as a duty in order to meet public health, environmental and animal safety standards. The CAP strives to guide and advice farmers on becoming economically competitive and applying environmentally-sustainable techniques. In order to avoid adverse side effects of certain farming practices, the EU makes available incentives to farmers to work in a manner that is sustainable and environmentally-friendly. The CAP also encourages certification systems that can guarantee environmental and animal wellbeing.²²⁰ A more precautionous attitude towards GMOs, like that of the EU, is worth being adopted too by South Africa.

Importantly: farmers, farm workers and the South African population, especially those living around farmed areas, should be better, or regularly, informed of the laws regarding agriculture and the risk to which their environment is exposed as a consequence of farming.²²¹ In other words, there is a need for increased interaction between communities and their environment. Then, there is no doubt that agricultural trade will represent little threat to the South African environment, and live up to what the WTO has hoped for, that is, profitable international trade in an environmental friendly agricultural sector.²²²

Research Paper Approximately 20,700 words (Chapters and footnotes only)

²¹⁹ Civitas EU Facts 'Common Agricultural Policy' (2011) available at <http://www.civitas.org.uk/eufacts/FSPOL/AG3.htm> [accessed on 13/11/2012].

²²⁰ European Commission 'The Common Agricultural Policy: A partnership between Europe and farmers' (2012) 5, 12 available at http://ec.europa.eu/agriculture/cap-overview/2012_en.pdf [accessed 13/11/2012].

²²¹ CSIR (2010) 1

²²² WTO 'Agriculture negotiations: Background' (2012) available at http://www.wto.org/english/tratop_e/agric_e/negs_bkgrnd11_nontrade_e.htm [accessed on 26/10/2012].

BIBLIOGRAPHY

BOOKS

Agarwal SK *Air Pollution* (2009) New Delhi: APH Publishing Corporation

Agarwal SK *Water Pollution* (2005) New Delhi: APH Publishing Corporation

Basak NN *Irrigation Engineering* (1999) Delhi: Tata MacGraw-Hill

Bosetti V & Lubowski RN *Deforestation and Climate Change: Reducing Carbon Emissions from Deforestation and Forest Degradation* (2010) UK and USA: Edward Elgar Publishing Limited

Botkin D & Keller E *Student Review Guide to Accompany Environmental Science: Earth as a Living Planet* 5ed (2005) Hoboken, NJ: Wiley

Carr I *International Trade Law* 4 ed (2010) USA and Canada: Routledge-Cavendish

Clay JW *World Agriculture and the Environment: A Commodity-By-Commodity Guide to Impacts and Practices* (2004) Washington, DC: Island Press

Desta MG *The Law of International Trade in Agricultural Products – From GATT 1947 to the WTO Agreement on Agriculture* (2002) The Hague: Kluwer Law International

Flint CR *The Geography of War and Peace: From Death Camps to Diplomats* (2005) USA: Oxford University Press

Gonzalez AG *The Protection of Maize Under the Mexican Biosafety Law: Environment and Trade* (2010) Gottingen, Germany: Gottingen University Press

Hoyle MSW *The Law of International Trade* (1981) Great Britain: The Laureate Press London

Jarman M *Climate Change* (2007) London; Ann Arbor, MI: Pluto

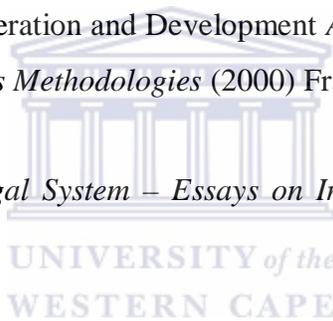
Kidd M *Environmental Law* (2008) Cape Town: Juta

King A *Ten Years with NAFTA: A Review of the Literature and an Analysis of Farmer Responses in Sonora and Veracruz, Mexico* (2006) Mexico: CIMMYT

Lurquin PF *High Tech Harvest: Understanding Genetically Modified Food Plant* (2002) USA & UK: Westview Press

Organisation for Economic Co-Operation and Development *Assessing the Environmental Effects of Trade Liberalisation Agreements Methodologies* (2000) France: OECD

Palmer N D *The WTO as a Legal System – Essays on International Trade Law and policy* (2003) London: Cameron May



Patrick L *International Trade and the Environment* (1992) Washington, DC: The World Bank

Peacock KW *Biotechnology and Genetic Engineering* (2010) New York: Facts on File

Sivashanmugam P *Basic Environmental Science and Engineering* (2007) Delhi: Summit Pal Jain

Thornton J & Beckwith S *Environmental Law* 2 ed (2004) London: Sweet & Maxwell

Trade and Industry Policy Secretariat /International Institute for Sustainable Development *Trade and Environment: South African Case-Studies* (1999) Johannesburg: Trade and Industry Policy Secretariat; International Institute for Sustainable Development

Van der Linde M *Compendium of South African Environmental Legislation* (2006) Pretoria: Pretoria University Law Press (PULP)

Wiers J *Trade and Environment in the EC and the WTO A Legal Analysis* (2003) Groningen: Europa Law Pub

CHAPTERS IN BOOKS

Molle F & Berkoff J 'Water pricing in irrigation: The lifetime of an idea' in Molle F & Berkoff J (eds) *Irrigation Water Pricing: The Gap Between Theory and Practice* (2007) UK: CAB International

Stocker T 'Earth in the greenhouse – a challenge for the twenty-first century' in Cottier T, Nartova O & Bigdeli SZ (eds) *International Trade Regulation and the Mitigation of Climate Change: World Trade Forum* (2009) Cambridge, UK; New York: Cambridge University Press

Tredoux G & Talma AS 'Nitrate pollution of groundwater in southern Africa' in Xu Y & Usher B (eds) *Ground Water Pollution in Africa* (2006) Great Britain: Taylor and Francis/Balkema

Wainwright J 'Weathering, soils, and slopes processes' in Jamie W (ed) *The Physical Geography of the Mediterranean* (2009) USA: Oxford University Press

Wuger D 'The many faces of modern biotechnology' in Wuger D & Cottier T (eds) *Genetic Engineering and the World Trade System, World Trade Forum* (2008) Cambridge; New York: Cambridge University Press

Zdruli P, Kapur S, Pagliai M & Cano AF 'What we know about the saga of land degradation and how to deal with it' in Zdruli P, Kapur S, Pagliai M & Cano AF (eds) *Land Degradation and Desertification: Assessment, Mitigation and Remediation* (2010) London; New York: Springer

JOURNAL ARTICLES

Bennett R, Ismael Y, Morse S & Shankar B 'Reductions in insecticide use from adoption of Bt cotton in South Africa: Impacts on economic and toxic load to the environment' (2004) 142 *The Journal of Agricultural Science* 665 - 74

Charnovitz S 'The NAFTA Environmental Side Agreement: Implications for environmental cooperation, trade policy, and American treatymaking' (1994) 8 *Temple International and Comparative Law Journal* 257 – 314

Cloete TE, Nel LH & Theron J 'Biotechnology in South Africa' (2006) 24 *Trends in Biotechnology* 557 - 62

Dunlap RE 'Trends in public opinion towards environmental issues: 1965-1990' (1991) 4 *Taylor & Francis Group* 285 – 312

Erisman JW, Bleeker A, Hensen A & Vermeulen A 'Agricultural air quality in Europe and the future perspectives' (2008) 42 *Atmospheric Environment* 3209 - 17

Forde CD 'Irrigation in South Africa' (1925) 65 *The Geographical Journal* 342 - 49

Jackson LA 'Agricultural trade and climate change: Can the WTO promote resilience in the face of uncertainty' (2008) 9 *Georgetown Journal of International Affairs* 25 - 32

Jager-Waldau A, Szabo M, Scarlet N & Monforti-Ferario F 'Renewable electricity in Europe' (2011) 15 *Renewable and Sustainable Energy Reviews* 3703 - 16

Johnston BF & Mellor JW 'The role of agriculture in economic development' (1961) 51 *The American Economic Review* 566 - 93

Jovanovic NZ, Annandale JG, van der Westhuizen AM & Steyn JM 'Monitoring the effect of irrigation with gypsiferous mine wastewater on crop production potential as affected by soil water and salt balance' (2004) 2 *The Journal of The South African Institute of Mining and Metallurgy* 73 - 82

Khakee F 'The North American Free Trade Agreement: The need to protect transboundary water resources' (1992) 6 *Fordham International Law Journal* 847 - 94

Le Roux P, Du Preez CC, Strydom MG, van Rensburg LD & Bennie ATP 'Effect of irrigation on soil salinity profiles along the lower Vaal River, South Africa' (2007) 33 *Water SA* 473 - 78

Lin J, Biyela PT, Puckree T & Bezuidenhout CC 'A study of the water quality of the Mhlathuze River, KwaZulu-Natal (RSA): Microbial and physico-chemical factors' (2004) 30 *Water SA* 17 - 22

Maluleke KR & Worku Z 'Environmental determinants of asthma among school children aged 13-14 in and around Polokwane, Limpopo Province, South Africa' (2009) 6 *International Journal of Environmental Research and Public Health* 2354 - 74

Moyo M, Bairu MW, Amoo SO & van Staden J 'Plant biotechnology in South Africa: Micropropagation research endeavours, prospects and challenges' (2011) 77 *South Africa Journal of Botany* 996 - 1011

Ozdogan M, Rodell M, Beaudoin HK & Toll DL 'Simulating the effects of irrigation over the United States in a land surface model based on satellite-derived agricultural data' (2010) 11 *Journal of Hydrometeorology* 171 - 83

Pollack MA & Shaffer GC 'Biotechnology: The next transatlantic trade war?' (2000) 23 *The Washington Quarterly* 41 - 54

Qaim M & Zilberman D 'Yield effects of genetically modified crops in developing countries' (2003) 299 *Science* 900 - 902

Rietz DN & Haynes RJ 'Effects of irrigation-induced salinity and sodicity on soil microbial activity' (2003) 35 *Soil Biology and Biochemistry* 845 - 54

Rodriguez E, Sultan R & Hilliker A 'Negative effects of agriculture on our environment' (2004) 3 *The Traprock* 28 - 32

Rogerson GM 'Urban agriculture in South Africa: Scope, issues and potential' (1993) 30 *GeoJournal* 21 - 8

Schaper M, Jofre J, Uys M & Grabow MOK 'Distribution of genotypes of F-specific RNA bacteriophages in human and non-human sources of faecal pollution in South Africa and Spain' (2002) 92 *Journal of Applied Microbiology* 657 - 67

Sheierling SM 'Overcoming agricultural water pollution in the European Union' (1996) 33 *Finance and Development* 32 - 5

Tilman D 'Global environmental impacts of agricultural expansion: The need for sustainable and efficient practices' (1999) 96 Colloquium paper, *National Academy of Science* 5995 - 6000

Van der Laan, Van Antwerpen & Bristow KL 'River water quality in the northern sugarcane-producing regions of South Africa and implications for irrigation: A scoping study' (2012) 38 *Water SA* 87 - 96

Venneria E, Fanasca S, Monastra G, Finotti E, Ambra R, Azzini E, Durazzo A, Fodai MS & Maiani G 'Assessment of the nutritional values of genetically modified wheat, corn, and tomato crops' (2008) 56 *Journal of Agricultural and Food Chemistry* 9206 - 14

INTERNET SOURCES

Agricultural Research Council 'Pesticide impact on human and environmental health' (2010) available at <http://www.arc.agric.za/home.asp?pid=947> [accessed on 25/09/2011]

American Public Media 'History of genetic engineering' (2012) available at http://americanradioworks.publicradio.org/features/gmos_india/history.html [accessed on 10/04/2012]

Anker Coal/Golfview Mining – Leliesfontein (State v Kruger & others) available at <http://cer.org.za/wp-content/uploads/2011/12/Golfview-Mining-Leliesfontein.pdf> [accessed on 12/11/2012]

Baldock D, Caraveli H, Dwyer J, Einschütz S, Petersen JE, Sumpsi-Vinas J & Varela-Ortega C 'The environmental impacts of irrigation in the European Union' (2000) i available at <http://ec.europa.eu/environment/agriculture/pdf/irrigation.pdf> [accessed on 05/05/2012]

Ballayan D 'Soil Degradation' (2000) 1 available at <http://www.unescap.org/stat/envstat/stwes-04.pdf> [accessed on 05/05/2012]

Barnett P 'The effects of deforestation' (2008) available at <http://www.helium.com/items/849747-the-effects-of-deforestation> [accessed on 13/11/2012]

Beyer WN 'Evaluating soil contamination' (1990) *US Fish and Wild Life Service, Biological Report 90 (2) 1* available at http://www.nwrc.usgs.gov/wdb/pub/others/FWS_Bio_Rep_90-2.pdf [accessed on 27/05/2012]

Bredahl ME & Holleran E 'Technical regulations and food safety in NAFTA' 72 available at <http://ageconsearch.umn.edu/bitstream/16906/1/ag970071.pdf> [accessed on 22/03/2012]

Censorbugbear 'Dangerous water pollution in South Africa' (2009) available at <http://censorbugbear-reports.blogspot.com/2009/03/south-africa-claims-water-is-basic.html> [accessed on 07/06/2012]

CIA 'The world fact book: GDP – composition by sector' (2011) available at <https://www.cia.gov/library/publications/the-world-factbook/fields/2012.html> [accessed on 08/10/2011]

Civitas EU Facts 'Common Agricultural Policy' (2011) available at <http://www.civitas.org.uk/eufacts/FSPOL/AG3.htm> [accessed on 13/11/2012]

COHA 'NAFTA, CAFTA-DR, and the role of the environment' (2006) available at http://williambowles.info/americas/coha_nafta.html [accessed on 27/04/2012]

Collins J 'Deforestation' (2001) available at <http://www.bcb.uwc.ac.za/envfacts/facts/deforestation.htm> [accessed on 20/04/2012]

CSIR 'The impact of an unhealthy environment on human health in South Africa' (2010) *Briefing Note* 2009/04 1 available at http://www.csir.co.za/nre/docs/Briefing%20Note%20No4%202010_environmental%20health_FINAL.pdf [accessed on 18/06/2012]

Dalvie MA, Cairncross E, Solomon A & London L 'Contamination of rural surface and ground water by endosulfan in farming areas of the Western Cape, South Africa' (2003) 1 available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC153526/pdf/1476-069X-2-1.pdf> [accessed on 20/06/2012]

Deduce 'Land take by intensive agriculture' (2011) 1 available at <http://www.deduce.eu/IFS/IFS06.pdf> [accessed on 30/04/2012]

Dennis JH & Nell WT 'Precision irrigation in South Africa' (2002) 1 available at <http://ageconsearch.umn.edu/bitstream/7023/4/cp02de01.pdf> [accessed on 30/04/2012]

Department of Agriculture, Forestry and Fisheries Republic of South Africa 'Estimate of the Contribution of the Agricultural Sector to Employment in the South African Economy' (2010) 1 available at http://www.daff.gov.za/docs/Economic_analysis/Contribution_agriculture_sectorSAeconomy.pdf [accessed on 08/10/2011]

Department of Environmental Affairs and Tourism 'South Africa country report: Fourteenth session of the United Nations Commission on sustainable development' (2005) available at <http://www.un.org/esa/agenda21/natlinfo/countr/safrica/atmosphere.pdf> [accessed on 10/05/2012]

Department of International Relations and Cooperation-RSA 'The Convention to Combat Desertification in those countries experiencing serious Drought and/or Desertification, particularly in Africa (CCD)' (2006) available at <http://www.dfa.gov.za/foreign/Multilateral/inter/treaties/ccd.htm> [accessed on 01/03/2012]

Dr. Buthelezi M 'African stockpiles – agricultural waste' (2007) 5 available at <http://www.pmg.org.za/minutes/20071120-national-nuclear-regulator-annual-report-200607-briefing-0> [accessed on 06/04/2012]

Dr. Goldblatt A 'Agriculture: Facts and trends South Africa' (2010) 2 available at <http://www.climatefruitandwine.co.za/download/WWF.Agric.FactsheetJune.10.pdf> [accessed on 28/04/2012]

Dr. Scholes RJ, van der Merve M, John J & Oosthuizen R 'State of the environment - South Africa: Climatic and atmospheric change' (1999) available at <http://www.ngo.grida.no/soesa/nsoer/issues/climate/index.htm> [accessed on 13/11/2012]

Environmental Monitoring Group 'Soil degradation' available at <http://www.bcb.uwc.ac.za/inforeep/land1.htm> [accessed on 05/05/2012]

Environmental Pollution Centre 'Water pollution causes' available at <http://www.environmentalpollutioncenters.org/water/causes/> [accessed on 13/11/2012]

Enviroplus 'Engineering for a clear future' (2008) available at <http://www.enviroplus.co.za/index.php?a1=70> [accessed on 15/04/2012]

EU 'The history of the European Union' available at http://europa.eu/about-eu/eu-history/index_en.htm [accessed on 21/03/2012]

EUR-Lex Access to European Union Law 'Judgment of the Court (Fifth Chamber) (2000) available at http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!CELEXnumdoc&lg=en&numdoc=61997CJ0418 [accessed on 12/04/2012]

Europa 'Summaries of EU legislation: Waste management' available at http://europa.eu/legislation_summaries/environment/waste_management/index_en.htm [accessed on 14/04/2012]

European Commission 'The Common Agricultural Policy: A partnership between Europe and farmers' (2012) available at http://ec.europa.eu/agriculture/cap-overview/2012_en.pdf [accessed 13/11/2012]

European Commission-Directorate General for Agriculture 'Agriculture and the environment' (2003) 1-2 available at http://ec.europa.eu/agriculture/publi/fact/envir/2003_en.pdf [accessed on 02/04/2012]

Europedia 'EU agricultural policy' available at http://europedia.moussis.eu/books/Book_2/6/21/index.tkl?all=1&pos=297 [accessed on 01/04/2012]

FAO 'Fertilizer use by crop in South Africa' (2005) 8, 10 available at <ftp://ftp.fao.org/agl/agll/docs/fertusesouthafrica.pdf> [accessed on 27/05/2012]

Fidei S 'Terra Victus' (2011) 1-3 available at https://docs.google.com/viewer?a=v&q=cache:E6JhDRyjcl4J:www.homeveggiedome.co.za/attachments/Terra_Victus_trade_prospectus_v4.docx+&hl=en&gl=za&pid=bl&srcid=ADGEESjhO0MpzaNfLvCFGUbjGhli_S3SHTcngdIkl-Im3yqerK1d5quuSWUtHOJMHokhkOKcYIIMxxhDZ7Vz0qOKYCsKPxx8YGTEW-3nvtvZfXbjDqBStaqtP4SGw8OBiILyb508Rh&sig=AHIEtbTg_SKSSkquHj5hg80_8cF8XnFIPA&pli=1 [accessed on 15/04/2012]

G Meijerink & P Roza 'The Role of Agriculture in Economic Development' (2007) *Markets, Chains and Sustainable Development Strategy & Policy paper 4* 2 available at http://www.boci.wur.nl/NR/rdonlyres/98CCE2E3-0FA2-4274-BCA0-20713CA1E125/62608/Fullreport4_Meijerink_Roza.pdf [accessed on 02/04/2012]

Ghiso SJV 'NAFTA, environment and institutions: A critical analysis of the national and multilateral environmental institutions in Mexico, in light of trade liberalization in the agricultural sector' (2003) 2, 10 available at <http://www.cameronhepburn.com/VilasMScThesis.pdf> [accessed on 25/05/2012]

Giannakas K 'The new EU regulation on GMOs: Causes and consequences' (2003) available at http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1124&context=agecon_cornhusker [accessed on 11/04/2012]

Greenpeace 'Deforestation and climate change' available at <http://www.greenpeace.org.uk/forests/climate-change> [accessed on 25/04/2012]

Henriques G & Patel R 'NAFTA, Corn, and Mexico's agricultural trade liberalization' (2004) 3 available at <http://dspace.cigilibrary.org/jspui/bitstream/123456789/113/1/NAFTA%20Corn%20and%20Mexicos%20Agricultural%20Trade%20Liberalization.pdf?1> [accessed on 29/04/2012]

Hydroelectric Power Project EIA and SIA Requirements of SAPP Member Countries and Relevant Development Assistance Agencies and Banks, *Country Studies* 'South Africa' available at http://www.saiea.com/dbsa_handbook_update09/pdf/12SouthAfrica09.pdf [accessed on 01/03/2012]

Ingco M & Ng F 'Distortionary effects of state trading in agriculture: Issues for the next Round of Negotiations' (1998) 1 available at <http://elibrary.worldbank.org/docserver/download/1915.pdf?expires=1351688007&id=id&accname=guest&checksum=97356646D0F6E19B72A3F310C7EC51AD> [accessed on 31/10/2012]

Joslin T & Babinard J 'The Political economy of GMOs: Emerging disputes over food safety, the environment and biotechnology' (1999) 24 a draft prepared for discussion with the GMO project group, Department of Agricultural Economics, University of Illinois, Available at <http://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CFwQFjAA&url=http%3A%2F%2Fciteseerx.ist.psu.edu%2Fviewdoc%2Fdownload%3Fdoi%3D10.1.1.189.1067%26rep%3Drep1%26type%3Dpdf&ei=dly7T-7wE8KDhQfp5YCACO&usg=AFQjCNHLiJTgbE8iJFyaMccey--MCyylIA&sig2=e6UN9L7z17tWg55DPK-0WQ> [accessed on 10/04/2012]

Leguen de Lacroix E 'Agriculture and the environment' (2003) 2 available at http://ec.europa.eu/agriculture/publi/fact/envir/2003_en.pdf [accessed on 03/04/2012]

Letete T, Guma M & Marquard A 'Information on climate change in South Africa: Greenhouse gas emissions and mitigation options' 9 available at

http://www.erc.uct.ac.za/Information/Climate%20change/Climate_change_info-complete.pdf

[accessed on 17/04/2012]

Magagane L, Muronga F, Verster J, & Steenkamp E 'Market research on South African agriculture exports' (2008) 2-3 available at

<http://www.daff.gov.za/docs/researchP/MarkResechSAexp.pdf> [accessed on 25/09/2011]

Mongabay 'South Africa forest information and data' available at

http://rainforests.mongabay.com/deforestation/2000/South_Africa.htm [accessed on 27/04/2012]

NAFTA 'NAFTA' available at <http://www.naftanow.org/> [accessed on 20/03/2012]

Pillai M 'Advantages and disadvantages of intensive farming' (2011) available at

<http://www.buzzle.com/articles/advantages-and-disadvantages-for-intensive-farming.html>

[accessed on 28/04/2012]

Powlson DS, Addiscott TM, Benjamin N, Cassman KG & de Kok TM 'When does nitrate become a risk for humans?' (2008) 293 available at

<http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1102&context=agronomyfacpub>

[accessed on 05/05/2012]

Prof Hammes PS, Prof Reinhardt CF & Dr Webb EC 'Agricultural perspectives iii – impact of agriculture on the environment' available at

http://myfundi.co.za/e/Agricultural_perspectives_III_%E2%80%93_Impact_of_agriculture_on_the_environment [accessed on 17/04/2012]

Professor Donaldson L & Sir May R 'Health implications of genetically modified foods' (1999)

available at http://www.biotech-info.net/gmfoods_health_implications.pdf [accessed on 06/04/2012]

Rahlao S 'SA National REDD + initiative' (2010) 6 available at http://cap.org.za/workshop_03/day_1_session_1/Seb_SA%20National%20REDD%20Initiative.pdf [accessed on 19/04/2012]

Scribd 'The issue's of deforestation in Southern Africa' available at <http://www.scribd.com/doc/7502789/The-Issues-of-Deforestation-in-Southern-Africa> [accessed on 24/04/2012]

Secretariat of the Stockholm Convention on Persistent Organic Pollutants United Nations Environment Programme available at <http://www.pops.int/documents/signature/signstatus.htm> [accessed on 26/10/2012]

Sharma R 'Multilateral trade negotiations on agriculture - A resource manual, module 4: agriculture in the GATT: A historical account' available at <http://www.fao.org/docrep/003/x7352e/x7352e04.htm#comm3> [accessed on 12/02/2012]

Slocum R 'Rethinking hazardous waste under NAFTA' (2009) available at http://ban.org/library/Features/090810_rethinking_hazardous_waste_under_nafta.html [accessed on 02/04/2012]

SoCo Project Team 'Addressing soil degradation in EU agriculture: Relevant processes, practices and policies' (2009) v available at http://eusoils.jrc.ec.europa.eu/esdb_archive/eusoils_docs/other/EUR23767.pdf [accessed on 10/05/2012]

South African Human Rights Commission 'Peace is its own reward' available at <http://www.sahrc.org.za/home/index.php?ipkMenuID=16&ipkArticleID=35> [accessed on 05/03/2012]

South African Waste Management Information Centre 'Approach to waste in South Africa' available at <http://www.sawic.org.za/?menu=17> [accessed on 11/04/2012]

South Africa Info 'South African agriculture' available at <http://www.southafrica.info/business/economy/sectors/agricultural-sector.htm> [accessed on 02/04/2012]

Strydom HA 'The legal principal relating to climate change' available at <http://www.eolss.net/Sample-Chapters/C14/E1-36-10-00.pdf> [accessed on 05/04/2012]

The South African Freeze Alliance in Genetic Engineering 'Where in South Africa are GE crops growing?' available at http://www.safeage.org/index.php?option=com_content&view=article&id=54&Itemid=43 [accessed on 06/04/2012]

Trautman NM, Porter KS & Wagenet RJ 'Modern agriculture: Its effects on the environment' (1985) available at <http://psep.cce.cornell.edu/facts-slides-self/facts/mod-ag-grw85.aspx> [accessed on 09/10/2011]

UNEP 'United Nations Environmental Program chemicals; Persistent organic chemicals' available at <http://www.chem.unep.ch/pops/> [accessed on 01/03/2012]

US Environmental Protection Agency 'Methane' (2011) available at <http://www.epa.gov/methane/> [accessed on 27/04/2012]

Van der Linde GJ & Pitse MA 'The South African fertiliser industry' (2006) 4, available at <http://www.fssa.org.za/medialib/Downloads/Home/Articles/THE%20SA%20FERTILISER%20INDUSTRY%20no%202%20Feb06%20AFA%20Conf%20fin.pdf> [accessed on 30/05/2012]

WTO 'Agriculture Negotiations: Backgrounder' (2012) available at http://www.wto.org/english/tratop_e/agric_e/negs_bkgrnd11_nontrade_e.htm [accessed on 26/10/2012].

WTO 'Agriculture: explanation' available at http://www.wto.org/english/tratop_e/agric_e/ag_intro01_intro_e.htm#ag_trade [accessed on 02/03/2012]

WTO 'Agriculture: Work in the WTO' available at http://wto.org/english/tratop_e/agric_e/negoti_e.htm [accessed on 16/06/2012]

WTO 'Technical Barriers to Trade' available at http://www.wto.org/english/tratop_e/tbt_e/tbt_e.htm [accessed on 01/03/2012]

WTO 'The GATT years: From Havana to Marrakech' available at http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact4_e.htm [accessed on 20/02/2012]

WTO 'The WTO agreement series; Sanitary and Phytosanitary Measures' (2010) 1 available at http://www.wto.org/english/res_e/booksp_e/agrmtseries4_sps_e.pdf [accessed on 01/03/2012]

WTO 'Understanding the WTO: Basics' available at http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact4_e.htm [accessed on 01/03/2012]

WTO 'Understanding the WTO' (2012) available at http://wto.org/english/thewto_e/whatis_e/what_stand_for_e.htm [accessed on 26/10/2012]

WTO 'Activities of the WTO and the challenge of climate change' available at http://www.wto.org/english/tratop_e/envir_e/climate_challenge_e.htm [accessed on 17/04/2012]

WTO News 'Free trade helps reduce poverty, says new WTO secretariat study' (2000) available at http://www.wto.org/english/news_e/pres00_e/pr181_e.htm [accessed on 20/06/2012]

WWF 'What causes global warming?' available at http://www.wwf.org.au/our_work/people_and_the_environment/global_warming_and_climate_change/science/global_warming_causes/ [accessed on 27/04/2012]

Yang T 'The effectiveness of the NAFTA Environmental Side Agreement's citizen submission process: A case study of the Metales y Derivados matter' (2004) 1 available at <http://www.ecologiaradical.com.mx/VB/Biblioteca/The%20Effectiveness%20of%20the%20NAFTA%20Environmental%20Side%20Agreement%E2%80%99s%20Citizen%20Submission%20Process.%20%20A%20Case%20Study%20of%20the%20Metales%20y%20Derivados%20Matter.pdf> [accessed on 05/04/2012]

Zahniser S & Link J 'NAFTA, agriculture trade, and the environment' (2002) 44 available at <http://www.ers.usda.gov/publications/wrs0201/wrs0201f.pdf> [accessed on 29/04/2012]

LIST OF CASES

ARCO Chemie Nederland Ltd et al v Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer et al [2000] EC Rep I-4475

EC-Hormones (US v European Communities) [1997] WTO DSB DS26

European Union Environment (Stichting Natuur en Milieu v College voor de Toelating van Gewasbeschermingsmiddelen en Biociden and others) [2010] the EU Court of Justice C-266/09

Trustees, Biowatch Trust v Registrar: Genetic Resources, and Others (2005) (4) SA 111 (T)

US Upland Cotton (Brazil v US) [2002] WTO DSB DS267

LEGISLATION

Atmospheric Pollution Prevention Act 55 of 1985

Constitution the Republic of South Africa Act 108 of 1996

Environmental Conservation Act 73 of 1989

Genetically Modified Organisms Act 15 of 1997

National Environmental Management Biodiversity Act 10 of 2004

National Forest Act 84 of 1998

National Water Resource Strategy (2004)

INTERNATIONAL INSTRUMENTS

WTO Agreement on Agriculture

WTO Agreement on Technical Barrier to Trade

WTO Sanitary and Phytosanitary Measures



REGIONAL INSTRUMENT

Treaty on European Union

OTHER SOURCES

Department of Agriculture, Forestry and Fisheries 'Pesticide management policy for South Africa' (2010) Government Gazette No. 33899

European Commission 'EU focus on waste management' (1999) *Office for Official Publications of the European Communities*

European Commission Directorate-General for Agriculture and Rural Development 'The Common Agricultural Policy explained'

Gardi C, Menta C, Montanarella L & Cenci R 'Main threats on soil biodiversity: The case of agricultural activities impacts on soil microarthropods' in Toth G, Montanarella L & Rusco E (eds) 'Threat to soil quality in the European Union' (2008) *European Commission Joint Research Center Institute for Environment and Sustainability*

Home R 'A short guide to European environmental law' (2007) *Papers in Land Management*

Jooste A & Van Zyl J 'Regional agriculture trade and changing comparative advantage in South Africa' (1999) *US Agency for International Development*

Kula-Seiteisho J & Wiechers H 'National waste management South Africa: Recycling component' (2006) *WOPRR Baseline Study Report & Implementation Plan*

SADC 'Regional Agricultural Policy (RAP) country summary agricultural Policy review reports' (2001)

Simi TB 'Brazil-US Upland cotton dispute: What does it augur for agricultural subsidies' (2005) *2 Trade Law Briefs*

Toth G 'Soil Quality in the European Union' in Toth G, Montanarella L & Rusco E (eds) 'Threat to Soil Quality in the European Union' (2008) *European Commission Joint Research Center Institute for Environment and Sustainability*

WEBSITES

www.wto.org

www.europa.eu/index_en.htm

www.sadc.int

www.nda.agric.za

