ORGANIC FARMING OR GENETIC ENGINEERING?

Sustainable Growing Systems for the Nambucca Shire

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Abbreviations

AA – Administrative arrangements
ABARE - Australian Bureau of Resource Economics
ABS – Australian Bureau of Statistics
ACO – Australian Certified Organic
ANEDO – Australian National Environmental Defenders Office
AQIS – Australian Quarantine and Inspection Service
Bt – *Bacillus thuringiensis*
BFA – Biological Farmers of Australia
CSIRO – Commonwealth Scientific and Industrial Research Organisation
DAFF – Department of Agriculture, Fisheries and Forestry
DNA - Deoxyribonucleic acid
ESD – Ecologically Sustainable Development
FAO – Food and Agriculture Organisation of the United Nations
FSANZ – Food Standards Australia New Zealand
GE – Genetic engineering
GEO – Genetically engineered organism
GM – Genetic modification
GTA – Commonwealth Gene Technology Act 2000
HR – Herbicide resistant
IFOAM – International Federation of Organic Agriculture Movements
IR – Insect resistant
LGA – Local Government Act
LGSA – Local Government and Shires Association of NSW
MNC – Mid North Coast
NASAA – National Association for Sustainable Agriculture Australia Ltd
NSESD – National Strategy on Ecologically Sustainable Development
NSOBP – National Standard for Organic and Biodynamic Produce
OGA – Organic Growers of Australia
OGTR – Office of the Gene Technology Regulator
OPC - Organic Produce Certificate

PHAA – Public Health Association of Australia
PPP – Polluter Pays Principle
RIRDC – Rural Industries Research and Development Corporation
RNA - Ribonucleic acid

PART 1

- Introduction

In Australia, Ecologically Sustainable Development (ESD) applies to all forms of development, including, but not limited to, roads and buildings, forestry and agriculture. In order for ESD to be achieved, all aspects of community and government must work towards creating a sustainable way of life. Consequently, the NSW Department of Agriculture, Forestry and Fisheries (DAFF) adopted the *Policy for Sustainable Development of Agriculture,* which specifically applies the principles of ESD to the context of agriculture. Thus, to sustainably develop agriculture requires a consistency between the general principles of ESD and the DAFF policy.
ESD is central to agriculture for several reasons. First, it is agriculture that feeds most people in the world and will, we hope, continue to feed future generations. Second, eating is our closest, most intimate relationship with nature as we literally incorporate

food into our bodies. Third, agriculture (including non-food products) is economically vital to Australia in general and Nambucca in particular. Fourth, the need for sustainability has been increasingly emphasised as we learn more about the potentially disastrous effects of anthropogenic (human-caused) climate change.

Throughout the world, genetic engineering (GE) has been promoted as a technology to lessen the environmental impacts of conventional agriculture while simultaneously promoting economic growth and producing healthy and affordable produce. However, while it is reasonable to expect that, when making determinations, the Office of the Gene Technology Regulator (GTR) would consider the principles of ESD, it does not. Without the regulatory regime considering the all principles of ESD, the release of genetically engineered organisms (GEOs) into the Australian environment, cannot, *prima facie* be said to promote ESD. Accordingly, this paper investigates the extent to which GEOs in agriculture are consistent with the principles and policies of ESD in agriculture.

Organic agriculture is increasingly promoted as more environmentally sensitive than conventional agriculture, economically viable, and is said to produce foods of a higher standard than those produced conventionally. Thus, prima facie, organic agriculture appears to be consistent with the principles of ESD in agriculture. Parts 4 and 5 of this paper investigate the degree to which these claims are substantiated.

As explained in Part 3.3.3, GE and organic agriculture cannot co-exist within the same locality; accordingly, local government areas, including the Nambucca Shire, need to choose which path to take. In discussing the merits, or otherwise, of both GE in agriculture and organic/biodynamic agriculture, this paper argues that it is organic agriculture that, on the principles of ESD, should be promoted locally, in the Nambucca Shire.

- Ecologically Sustainable Development and Agriculture

Facilitating the ESD of agriculture creates a challenge to integrate long-term productivity and economic viability with the protection of natural and biological resources and the improvement of human health and safety. Not surprisingly, this is something to work *towards,* "... the development of successful, sustainable agricultural enterprises may require significant change, or adjustment, from existing practices."

The NSW Department of Agriculture has established guidelines for the sustainable development of agriculture in the State. Agriculture is sustainable where it:

- responds to consumer needs for food and fibre products that are healthy and of high quality;
- takes full account of the costs of production, including environmental costs, and ensures its pricing reflects these costs;
- protects and restores the natural resource base on which agriculture depends;
- prevents adverse on-site and off-site impacts on the environment and any other sector of the community;
- is flexible in order to accommodate regional differences and changing economic, environmental and social circumstances such as drought or terms of trade;
- is financially viable both now and in the future, and takes into

account the environmental and social impacts of production upon present and future generations.

In addition to satisfying these principles, to be sustainable, agricultural enterprises should also be consistent with the principles of ESD.

> ...ESD means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and quality of life for both present and future generations is increased.

Thus, ESD, both generally and with particular regards to agriculture, "involves consideration in an integrated way of the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere; and of a long term rather than short-term view when taking those decisions and actions."

To be successful, such an integrated approach requires cooperation between all tiers of government, neighbouring Councils and all sectors of the community. Indeed, the interrelated and interdependent objectives and principles of ESD are binding on all levels of government as of December 1992.

ESD incorporates three Core Objectives:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- To provide for equity within and between generations;
- To protect biological diversity and maintain essential ecological processes and life-support systems.

These objectives are augmented by seven guiding principles. As both principles and objectives carry equal weight, ESD is achieved when all these matters are taken into account from a balanced perspective.

The Guiding Principles are:

- decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations;
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- the global dimension of environmental impacts of actions and policies should be recognised and considered;
- the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised;
- the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised;
- cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms;
- decisions and actions should provide for broad community involvement on issues which affect them.

Under the principles of ESD, both the individual and collective aspects of the environment including biological diversity and life support systems are to be protected and maintained in a manner suited to the local region. However, global dimensions of actions and policies should be recognised. Thus ESD, both in general and with specific regard to agriculture, implies a conservation ethic.

1.1.2. The Environmental Component of ESD

Pursuant to s 528 EP&AA, 'environment' includes:

(a) ecosystems and their constituent parts, including people and communities; and

(b) natural and physical resources; and

- the qualities and characteristics of locations, places and areas; and
- heritage values of places; and
- the social, economic and cultural aspects of a thing mentioned in paragraph (a), (b) or (c).

This is an ‘inclusive’ conception of nature, with humans seen as part of nature. In this view, which emphasises nature is a land community of which humans are members just like other species and other aspects of ecosystems. As we note later in Part 2.1, the Commonwealth Gene Technology Act (GTA) uses a much narrower conception of nature, which does not mention people and therefore, by default, excludes them from the realm of the natural.

In order to maintain and protect the environment, it is prudent to apply the precautionary principle:

> When there are threats of serious or irreversible environmental damage lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This formula, which was originally adopted at Rio de Janeiro in 1992, has been criticized as not particularly clear. Essentially, what it means is that where it is claimed, on reasonable grounds, that a proposed activity may well cause environmental damage, the proposal should be put on hold until the concerns have been addressed.

Under the principles of ESD, serious and irreversible damage should be avoided where practicable and an assessment of consequential risks of various options should be weighted. Risk cannot be reduced to zero: it is an inevitable part of life, because most activities, from playing sport or driving a car to getting married or having a baby involve some degree of risk. For all activities, a standard of “acceptable risk” needs to be developed. This is especially important where individuals and organisations seek to impose risks on others. This report accepts that risk analysis is a valuable and necessary aspect of planning and regulation. However, it implicitly rejects the approach that quantifiable risks to human health and the environment are all that needs to be taken into account in evaluating projects such as the introduction of GEOs into the environment.

According to the principles of ESD in agriculture, offsite and onsite impacts should be prevented. According to the ‘polluter pays principle’ (PPP) all forms of pollution should be minimised and “those generating pollution and waste should bear all associated costs of containment, avoidance or abatement.” It should be noted that the PPP is in need of interpretation since the generation of pollution is a complex process. For example, it would be over-simplistic to lay responsibility for oil pollution and greenhouse gas emissions from vehicles entirely on motorists (or oil drilling companies, or petroleum refiners, or car manufacturers, or “the government”). The point of the PPP is that those who benefit from an activity should not be allowed to impose social and environmental harms as “externalities” that essentially amount to a subsidy from the community. For example, a person who wishes to play loud music all night should not expect his or her neighbour to lose sleep, but should either install effective soundproofing or turn the music down. Similarly, if a pig farm generates large volumes of excrement, the farmer should be expected to ensure that this waste is managed in such a way as not to cause odour, land and water pollution. As will be shown in Parts 3.1.2 and 3.3.2, there are serious concerns that the introduction of GEOs into the environment may have serious and irreversible effects, including destroying the possibility of organic farming. The PPP thus mandates considerable precaution before deciding to allow the introduction of such organisms.

In order to protect and maintain biodiversity and ecological integrity, humanity must recognize that we are part of the natural environment. Indeed, commentary on Agenda 21 suggests that recognising our integral interconnection to and placement in the natural environment ultimately requires a complementary shift in values, and that this shift in values “… is crucial to achieving a sustainable future.”

1.1.3. Human Rights, Social and Intergenerational Considerations of ESD

The principles of ESD apply both to individuals and collectives and within and between generations. This means that current and future generations should have fair and equal access to opportunities and natural resources that are healthy, affordable and of high quality. The acknowledgement of opportunities and access to resources within the current generation is met when individual and collective human rights enshrined in international and Australian law are satisfied. Fair and equal access of future generations to such resources will be met if future generations enjoy freedom and human rights to an equal or greater level than do current generations. The impacts of agricultural production should therefore take the social impacts upon both present and future generations into account.

Current generations should behave in a manner that maintains or enhances the health, biological diversity, ecological integrity and productivity of the environment, leaving behind a legacy of increased environmental wholeness for the benefit of future generations. In order to achieve this, we should, in the short term, minimise wasteful habits and consider how activities impact on future generations so as not to leave them with environmental debts. We should protect habitat of threatened species, sustainably manage natural areas and-recognise the interdependence of humans, species and natural processes. In the long term, current generations should promote diversity as it “… maintains stability and promotes adaptability ... [Current generations should] choose a development path which enhances genetic and ecosystem diversity." Being part of the ecosystem, it would be fair to say that diversity in all areas of human life should be encouraged. Community involvement in decision-making is also part of this tier of ESD.

1.1.4. Economics and ESD.

From an economic perspective, development should be integrative, viable and contribute positively to society and the environment. Viability can be promoted through economic diversity and flexibility that accommodates regional differences and changing economic, environmental and social factors. Flexibility in economic policies will help maintain and enhance international competitiveness in an environmentally sensible manner. Such economic development should grow in a direction that mutually supports environmental protection. Environmental factors should be included in the valuation of assets and services and the full costs of production, including environmental costs, should be reflected in pricing. Users of goods and services should pay the actual cost of the full life-cycle of natural resources and the disposal of waste, thereby reducing their ecological footprint. The establishment of incentive structures and market mechanisms will ensure environmental goals are cost-effective.

PART 2

2.0. Genetic Engineering in Australia

Around the world, the creation and release of genetically engineered organisms (GEOs) has created confusion and controversy. The confusion arises due to the lack of a clear and widely accepted definition of *genetic engineering* (GE), and because the term *genetic modification* (GM) is often used interchangeably with GE.

There is a very broad sense of GM that includes everything from the first attempts at selective breeding of plants by Neolithic farmers 10 000 years ago to the transfer of genetic material in laboratories via gene splicing between plant and animal organisms that are separated by well over a billion years of evolution. Both GM and GE are also used more narrowly to refer to any procedure that changes the genetic sequence of an organism in ways that could not have, or at least were extremely unlikely to have happened without human intervention, or more narrowly, without the techniques of sophisticated biotechnology. GE is sometimes used to refer specifically to the creation of transgenic organisms where genetic material from one species is introduced into the DNA of an unrelated species. Finally, GE may mean the creation of new genetic material that is not merely the product of combinations of elements of existing gene sequences. This paper refers to *genetic engineering* in a narrow sense, as discussed further below.

Commercial release of GEOs in Australia began in 1995 with the release of GE carnations with colour modification. In 1996, the wide scale release of the insect resistant cotton strain INGARD® was approved. Since that date, eight GE cotton lines and eight GE canola lines have been approved for commercial release. Three licences were granted in 2006 for the commercial release of the cotton strains Roundup Ready Flex®, Roundup Ready Flex®/Bollgard II® and Liberty Link®, the latter of which is for unrestricted commercial release in all areas of Australia. Linters (the short fibres left after longer fibres are removed) and oils from Liberty Link® cotton are also approved for use in human and animal feed by Food Standards Australia New Zealand (FSANZ). Two GE carnations, one for improved vase life and a blue variety were released in Australia during 1994 and 1996 respectively.

In NSW, there are licensed trial sites in Narrabri, Gunnedah, Bourke, Moree Plains, Wagga Wagga and the Greater Hume Shire, testing cotton, cultivated rice, and white clover. There are no licensed, exempt or low-risk GE organisms in the Nambucca Shire. However, the recent lifting of the NSW moratorium on the release of GE canola means that it is now possible to grow GE canola, which is approved for release in all canola growing areas of Australia. Similarly, the unrestricted licence to grow engineered cotton both north and south of latitude 22° and, in the case of Liberty Link® cotton, in all cotton growing areas of Australia means that~~,~~ engineered cotton can be grown in the Nambucca Shire. While cotton growing in the region may appear unlikely, historical evidence of cotton growing in the Nambucca Shire exists.

Trial licences for a genetically engineered fowl adenovirus vaccine and cattle vaccines for bovine rhinotracheitis and recombinant *Bovine herpesvirus* vaccines have also been granted. Trials with the adenovirus and rhinotracheitis vaccines were completed in 2004 and 1998, respectively. From 2005 – 2010 the *Bovine herpesvirus* vaccine is being trialed on 180 cows in contained facilities in Queensland. A recent licence application for the Australia-wide commercial release of imported transgenic zebra fish modified to express red, green and yellow florescent proteins for use as ornamental aquarium fish has been withdrawn. By request of the GTR, the Nambucca Shire Council had been invited to comment on the application. Subsequently, a motion was passed that Council raise concern with the GTR about the release of the transgenic fish into the community because of lack of information.

2.1. The Commonwealth Gene Technology Act.

The majority of the abovementioned intentional environmental/releases of genetically modified organisms (GMOs) was granted under the Federal Gene Technology Act 2000 (GTA) and accompanying regulations. Pursuant to that Act and the relevant State mirror legislation, live and viable GMOs may be researched, manufactured, produced, released and imported into Australia if the organism falls into one of four categories: (i) Exempt; (ii) Notifiable low risk dealing (iii) Dealings listed on the GMO register; or (iv) Licensed by the Gene Technology Regulator. All other *intentional* dealings are prohibited.

Due to the controversy surrounding the choice of words, and to distinguish genetic engineering from traditional breeding methods such as cross-pollination and hybridisation (genetic modification), this paper will refer to those organisms governed by the GTA as *genetically engineered organisms* (GEOs).

The object of the GTA is "... to protect the health and safety of people, and to protect the environment, by identifying *risks* posed by or as a result of gene technology, and by *managing* those risks through regulating certain dealings with GMOs." As noted earlier, the term "acceptable risk" is widely used. An Oxford University source states,

> The concept of Acceptable Risk is not particular easy to define. It is essentially a measure of the risk of harm, injury or disease arising from a chemical or process that will be tolerated by a person or group.
>
> Whether a risk is "acceptable" will depend upon the advantages that the person or group perceives to be obtainable in return for taking the risk, whether they accept whatever scientific and other advice is offered about the magnitude of the risk, and numerous other factors, both political and social.

Given the focus towards risk management, the GTA appears to be taking a position that some degree of harm to human health and safety or the environment is tolerable.

In making determinations about whether to grant licences for intentional release, the GTR must determine what amounts to an 'acceptable' risk.

> …[R]isk assessment deals as far as possible with objective [scientific] evidence, risk management necessarily involves prudential judgments about which risks require management (risk evaluation), the choice and application of treatment measures, and

ultimately whether the dealings should be permitted. Consequently, if there is uncertainty about risks (e.g. in early stage research) this may influence the management measures that are selected.

While scientific evidence and prudential judgment seeks to identify and manage risks, a baseline is required to determine what amounts to an 'acceptable risk'. The OGTR's Risk Assessment Framework establishes the baseline for intentional environmental release through comparison of the GEO with risks posed by unmodified parental organisms and established conventional, industrial agricultural practices. There appears to be an assumption that such practices do not present unacceptable levels of risk. Thus, if the risk of adverse outcomes from the release of a GEO is not greater than that posed by its unmodified counterpart and no greater than that posed by industrial agriculture, then the risk is deemed acceptable and the licence is likely to be granted.

2.2. Regulation of GE Food in Australia

Persons must comply with the Food Standards Code when conducting a food business or where food is intended for or is for sale. Standard 1.5.2 is of direct relevance to genetically engineered food and requires all food commodities produced using gene technology to be assessed for safety prior to approval for sale and use. Foodstuffs failing this assessment are prohibited from entering the food chain. According to that Standard, genetically engineered food is food produced using gene technology that contains novel (i.e. new) DNA and/or protein or has altered characteristics to conventional food of the same type. Because of the restrictive nature of this definition, so long as novel DNA/protein is not present in the final food, certain foods will not be considered genetically engineered, even where the food ingredient is derived from a genetically engineered plant.

Prior to entering the market place, food derived from GEOs must go through two assessment processes - firstly, to assess whether the GE foodstuff will be allowed into the market place, and secondly, to assess whether or not labelling is required.

2.2.1. Safety Assessment of GE Foods.

Food Standards Australia New Zealand (FSANZ) applies four principles to assess the safety of a GE food commodity, and like the GTA bases its decisions partly on the best scientific knowledge available. Best scientific knowledge includes information from the applicant, published scientific literature, general technical information, independent scientists, other regulatory agencies and international bodies and the community.

Three other principles govern the FSANZ risk assessment procedure: (i) a case-by-case approach, meaning that each type of genetic alteration is separately assessed; (ii) full and separate consideration of the safety of each new component in the GE foodstuff (i.e. new DNA/protein); and (iii) consideration of both intended and unintended effects.

2.2.2. Labelling of Food Containing Genetically Engineered Ingredients

Numerous foods containing GE ingredients are approved for sale in Australia, most of which are imported. Indeed, of locally generated GE products, only cotton linters and oil are commercially released and approved for human consumption in Australia. Imported products include soy bean, corn/maize, canola, sugarbeet and potato. Like approved GE processing aids and food additives, many of these ingredients do not require labelling under the current regime.

Labelling may be required where a foodstuff is known to be from an approved commercially released GE source. There are also numerous exemptions to labelling requirements under Standard 1.5.2, pursuant to which the following GE foods do not require labelling:

- Highly refined foods such as oils, sugars and starches;
- Processing aids and food additives including preservatives, antioxidants and thickeners;
- Flavours present in a quantity less than 0.1% in final food
- Food that unintentionally contains a GE ingredient in a quantity less than 1%;
- Food derived from an animal or organism that has been fed GE food. This includes bees and thus honey and pollen;
- Foods prepared for immediate consumption such as restaurant and takeaway foods.

Where a GE food ingredient is permitted in Australia and New Zealand and is not subject to the abovementioned labelling exemptions, the general requirement is that labelling is required where the final food or ingredient contains novel DNA or protein. Further and additional labelling identifying food or ingredients is required where the GE food or food ingredients:

- Has altered characteristics to matching conventional foods in relation to:
    - composition or nutritional values; or
    - anti-nutritional factors or natural toxicants; or
    - containing a new factor known to cause allergenic responses;
    - the intended use.
- Raise significant ethical, cultural and religious concerns.

Only one food and its derivates released into the Australian and New Zealand food chain has additional labelling – food derived from high oleic acid soybean lines G94-1, G94-19 and G168. Labelling of food thus derived is required to contain a statement noting that it contains ingredients engineered to contain high levels of oleic acid. All other approved varieties in Australia and New Zealand are deemed ‘substantially equivalent’ to conventional varieties and do not require additional labelling on the grounds mentioned in (i) above. Labelling will be required only if the final food product contains novel DNA or protein. Whether or not something contains novel DNA or protein is left up to the industry to determine and indicate.

PART 3

3.0 Genetic Engineering and Ecologically Sustainable Development.

Taking a limited risk-based approach, the Federal regime governing the intentional environmental release of GEOs does not consider all the principles of ESD either generally, or with specific regard to agriculture. Accordingly, whether the use of GEOs in agriculture is sustainable is questionable. This section seeks to address this question by testing GE against the three Core Objectives and principles of ESD in agriculture.

3.1. ESD, GE and Our Environment

The ambit of the term 'environment' in the GTA and its subsequent application by the GTR is narrower than that used in ESD. Under the GTA, 'environment' includes:

- Ecosystems and their constituent parts; and
- Natural and physical resources; and
- The qualities and characteristics of locations, places, and areas.

This definition of ‘environment’ is controversial. Unlike the EP&AA’s interpretation of 'environment', people and their communities, biodiversity values, agricultural land values and the social, economic and cultural aspects of (a) - (c) and their relationships are excluded from the definition. Consequently, social or economic impacts (including trade, marketing and contamination of non-GE organisms), ethical considerations, or the views of a particular community when making determinations are not considered by the GTR when making determinations under the GTA.

Through its failure to consider social, ethical and economic impacts of GE, the definition of ‘environment’ and the narrowly risk-based approach of the GTA separates what 'protecting the environment' means from its cultural milieu and seeks to reinterpret it in purely scientific terms. This definition of environment is therefore irreconcilable with the ESD goal to place humanity within the natural environment and the recognition of the interdependence of humans, species and natural processes.

This limited interpretation of ‘environment’ and the risk-based approach of the GTA maintain the status quo in favour of industry and marginalises non-scientific concerns surrounding technological development. In particular, the risk-based approach uses conventional agriculture as a baseline to determine acceptable risk. This means alternative agricultural practices such as organics and biodynamics are not considered, even if they are more environmentally sound. This failure effectively marginalises alternative farming practices.

As McGrath points out, "...the environment includes non-GM crops which might be grown in adjoining fields or kilometers away from a GM crop. These non-GM crops are part of the ecosystem which would [be] normally found in an agricultural area ..." However, the limited interpretation of s10 (1) (c) GTA means that the GTR may not stipulate that buffer zones be created as a licence condition. For example, in the case of an application to licence the commercial release of GE canola in 2003, the GTR did not require buffer zones as a criterion on the licence even though it noted that “some pollen flow between crops is inevitable.” The GTR considered … that [i]mplementation of a 5m buffer between adjacent GM and non-GM canola fields would not preclude gene flow between the two crops” and that any co-mingling of InVigor® canola with other

varieties did not pose any additional risk to human health or the environment.
Moreover, as the amount of genetically engineered crops increases, and thus changes to the nature of the receiving environment ensue, the baseline will change accordingly. This has already occurred in the cotton industry, where the GTR has noted that the widespread use of genetically engineered cotton "... forms part of the baseline data for establishing the risks that may result from ... release." Thus, where a specific crop becomes dominated by GE varieties the baseline will shift further in support of GEOs.

> The rationale behind using conventional agricultural practices as the baseline for acceptable risk comparisons is that the risks posed to the environment by conventional agriculture have already been accepted by society … [this] assumes that the public does indeed consider the levels of risk to the environment from conventional agriculture to be acceptable [which is a highly questionable assumption].

CSIRO scientists have noted the need to move from the purely risk-based approach governing the introduction of GEOs into the environment. "...[F]or well-known traits, we need to move away from a model of assessing risk to one of assessing the degree to which the new technology improves, or detracts from the delivery of social, economic and environmental aspirations."

The risk-management emphasis is also hard to reconcile with the precautionary principle. The principle was inserted into the GTA at the last minute and consequently, it is considerably weaker than that used in the Intergovernmental Agreement on the Environment 1992 (IAE) and thus the majority of Australian environmental law. The precautionary principle adopted in the IAE aims to make addressing serious environmental threats mandatory, however, the weaker version found in the GTA limits this to cost-effectiveness. Yet even this diluted version of the precautionary principle is not clearly required to be considered by the GTR when making its determinations under the Act. In order to achieve the object of the GTA, the GTR is only required to use the precautionary principle in the regulatory framework.

The limitations of the risk-based approach, in conjunction with inclusion of a weaker version of the precautionary principle in the GTA raises questions about the extent to which the regulatory regime adheres to the conservation ethic of ESD both generally, and with regards to agriculture, and rather than seeking to avoid serious and irreversible damage, seems to legitimise environmental degradation. Moreover, the failure of the GTA to require, and consequently, the GTR to consider the wider social implications of the environmental release of GEOs means that the narrow risk-based approach fails to take into consideration issues pertinent to the community.

3.1.1. Impacts on Genetic and Biodiversity

The GTR has not commissioned research into the impacts of the escape of GEOs on Australian biodiversity. There is also no legal mechanism to quantify species and biodiversity loss. Yet, it is not possible to completely contain GMOs, once they are released into the open environment and the "… isolation requirements that apply to field trials are designed to minimise rather than prevent dissemination of the GMO or its genetic material." Indeed,

> ... it is quite impossible to reckon what the effects of some genetic change will be on the ecosystem that changed organism is found in… and [t]he impacts of [GEOs] upon biodiversity, especially in intergenerational terms, are largely unknown,

Despite the inevitability of escape, and the unknown nature of the environmental consequences, issues pertaining to physical or genetic contamination of non-GE organisms or the land or consequences of that contamination are outside the ambit of the GTA. Thus, the intentional environmental release of GEOs is contrary to the ESD goals of protecting and maintaining biodiversity and avoiding serious and irreversible damage.

While outside of the consideration of the GTR, there are legitimate concerns surrounding the environmental impact of the release of GEOs. Of particular relevance, and concern to GE and biodiversity, is the transfer of genes from engineered varieties both within and between species. Gene flow to wild relatives, known as vertical gene transfer, allows genes to be transferred *within* species. If this occurs, crops modified for herbicide resistance may hybridize with wild relatives, increasing survival fitness, spread and persistence, thus threatening wild varieties with decline, and in the worse-case scenario, extinction.

Increased potential for weediness is greater in herbicide tolerant, pest resistant and drought hardy GE crops than those engineered for increased nutritional quality. Indeed, there are concerns in Australia that herbicide resistance from Roundup Ready® canola will transfer to its relative, wild radish, which has already developed resistance to numerous herbicides. Wild radish is a major pest in Southern Australia, with a current annual sum in excess of $40 million spent on its control.

If fitness and competition advantage transfer from GEOs to wild populations, native flora and fauna are at risk of decline. This risk is highlighted in the case of virus resistant transgenic white clover, which has been developed in Australia to withstand CIYW and AMV viruses, two viruses which reduce the growth, productivity and nodulation rate of white clover in native grassland and woodland environments of south-eastern NSW. The spread of the virus-resistant transgenes to wild populations is likely, and could ultimately lead to increased weediness or invasiveness of white clover into native, and especially sub-alpine and alpine, environments. Given that such environments are ecologically significant, containing endemic and spatially restricted native flora, and that exotics in these locations are increasing, "...further invasion by exotic plant species threatens the ecological integrity of these communities." Clearly, the potential decline of biodiversity, both with regards to the transgenic white clover, and more generally with regards to GEOs, is contrary to the ESD in agriculture goal of protecting and maintaining biodiversity.

A similar concern surrounds genetic contamination of conventional varieties with plants engineered for resistance to viral infections, such as virus resistant squash and papaya that are commercially produced in the USA and commercially released cotton strains in Australia. The concern is that transgenes introduced to confer disease resistance will recombine with another, often related virus, creating hitherto unforeseen viral strains. There is evidence of recombination of viruses, especially RNA virus, and introduced transgenes causing diseases distinct from the parental strain and hybrid viruses more pathogenic than their parental strain. Further evidence shows transgenic plants *(Brassica napus)* expressing genes from the cauliflower mosaic virus (CaMV) recombining with mutant CaMV and restoring the lacking genes. CaMV has also been shown to recombine to produce altered symptoms and an extended host range. Once again, this is contrary to the ESD goal of protecting and maintaining biodiversity.

3.1.2. Pesticides and Pollution

When it comes to the use of pesticides and associated environmental pollution, the intentional environmental release of GEOs is contrary to the ESD in agriculture principle of avoiding serious and irreversible damage where practical. Despite claims that GE crops in general reduce the frequency and amount of herbicide applications and thus are environmentally beneficial, the only comprehensive report focusing on the impact of all major commercial herbicide tolerant crops (HT) (soybean, cotton, and canola) on pesticide use in the US during 1996 - 2003 concluded that pesticide use increased by 70 million pounds. A report on pesticide use in Australia between the years of 1996 - 2000 does not provide a quantitative analysis of the degree to which herbicide applications have increased/decreased as a result of HT technologies. However, where more virulent herbicide-resistant weeds develop and/or shifts in composition of weed communities and/or volunteer crops from GE varieties persist in the environment, herbicide use and/or application rate will potentially increase and more toxic chemicals will be required to control them, thus offsetting any initial reductions in herbicide use.

If this occurs, changes in weed control strategies via the application of more toxic chemicals such as 2,4-D will ensue. Considerable adverse economic, social and environmental impacts could result should resistance to even these highly toxic chemicals develop. Engineering resistance to even 2,4-D has already been researched in Australia – trials seeking to create resistance in cotton to spray drift of 2,4-D from neighboring properties were undertaken during 1995 – 2000. Weed resistance could also result from the survival of HT GE crops outside of cultivated areas. Biotypes of Australian weeds such as wild oat, barley grass, cape weed and annual ryegrass, have shown resistance to haloxyfopmethyl, paraquat, paraquat/diquat and glyphosate respectively.

The situation is somewhat similar with regards to Bt varieties. In Australia, used in conjunction with integrated pest management strategies, Bt cotton has resulted in a 40 - 50% reduction in insecticide applications, equating to between 12-15% pesticide-use reductions on a net-unit basis across the entire cotton industry. However, the Australian Academy of Technological Sciences and Engineering (AATSE) has reported that Bt technology will allow cotton production to expand into new and environmentally sensitive areas, such as northern Australia, and therefore lead to an aggregate increase in pesticide use that would offset any reduction in pesticide application. Furthermore, this industry expansion would result in loss of biodiversity through the conversion of natural ecosystems into agricultural areas. This impact is contrary to the strategies identified in ESA to protect and promote native vegetation and biodiversity in agricultural land management.

Evidence has also suggested that the rate of insect-resistance could increase with the introduction of insect-resistant crops, such as Bt varieties. Bt crops produce insecticide for most of their lives and given that continued exposure increases the rate of insect resistance, the amount of resistant individual pests increases over time. Insect resistance will determine the impact of Bt crops on pesticide applications:

> ... [I]f Bt cotton led to resistance in *Helicoverpa armigera,* Bt-based insecticide sprays might become ineffective. This would remove one of the most environmentally friendly insecticides (and one of the few insecticides available to organic producers of other crops) ...

> [thereby] plac[ing] farmers in a similar position to the old "pesticide treadmill", where they remain reliant on the future technological releases from pesticide companies [sic biotech] to remain viable.

It seems that insect resistance may already be developing: In 2001, hundreds of hectares of insect-resistant GM cotton in Makassar, South Sulawesi, were destroyed by pests despite assurances by Monsanto that the variety was resistant to all types of pests. Similarly, amongst other strategies such as removal of volunteer cotton plants, Australian farmers using INGARD® cotton have been advised by the Transgenic and Insect Management Strategy Committee of the Australian Cotton Growers Research Association to spray additional insecticide to control *Helicoverpa armigera* because of "... reduced INGARD plant efficacy."

The development of resistance by weeds and pests to agricultural chemicals and consequential effects on agricultural productivity, impacts on native flora and fauna and human and animal health are problematic from the point of the ESD of agriculture. To this end, in controlling agricultural weeds and pests, reducing reliance on pesticides and associated human and environmental risks is crucial. Resultant effects of the abovementioned potential impacts on native flora and fauna and the potential for escaped GEOs to persist, spread and accumulate in the environment conflict with the ESD in agriculture principle of protecting and maintaining biological diversity and life support systems. These effects are contrary to the DAFF policy to develop and adopt management practices and farming systems that conserve and enhance the health of soil resources and biodiversity in general. Further against that policy is the potential for GE varieties such as the transgenic white clover to adversely affect areas set aside for nature conservation.

3.1.3. Potential Impacts on Soil and Water

There are concerns that transgenes will persist, degrade and spread into the natural environment, accumulate in soils and through the processes of eluviation and immission, enter the water table. Consequently, the release of GEOs into the environment risks upsetting life-support systems – a primary concern of ESD. For example, a recent report by CSIRO concluded that in the case of Bt cotton, the Bt insecticidal toxin is present in every part of the plant, is expressed for the life of the plant, is expressed the most in fine roots and enters the soil environment for the life of the plant. Thus, the Bt transgene has the potential to enter the soil system both during and after harvesting and has been detected in rhizosphere soils where the cotton is grown. This finding is contrary to the assumption that Bt toxin is only expressed in foliage and thus can only enter the environment after harvesting. This incorrect assumption is the basis upon which Risk Assessment and Risk Management Plans were undertaken and licences granted for commercially released cotton strains in Australia.

The CSIRO report indicated the unknown ecological impacts of continued exposure to the toxin and the need for further investigations into the environmental fate of root-derived Bt toxins on the rhizosphere zone, soil biota, and microbial population growth due to significant differences in the composition of biota between residues of Bt and non-Bt cotton. Increased amounts of soil fungi were associated with Bt cotton, thus raising the potential for soil-borne plant diseases. The report also noted that microorganisms do not easily degrade the Bt toxin and if it is not degraded by insect larvae or sunlight it will potentially accumulate if bound and protected by soil particles.

Bt toxin is known to remain active after the lifecycle of the plant and to bind to clay and humic acids and to persist in the environment for at least 234 days, with potential consequential effects to non-target organisms, population dynamics and ecosystem functions.

The potential for Bt toxins to spread and persist in the environment, raises issues about the extent to which GE and the GTA are consistent with the ESD in agriculture goal of minimizing pollution. Genetic pollution is a serious and irreversible potential impact of the releases of GEOs and failure by the GTA to deter such environmental impacts through the implementation of a user-pays regulatory regime indicates a further conflict between the GE regime and GE, and the ESD principle of placing liability on those causing the pollution to contain, avoid or abate pollution incidents.

3.2. GE and ESD: Human Rights, Social and Intergenerational Considerations

This tier of ESD requires human rights enshrined in international rights law to be respected and for both current and future generations to have equal and fair access to opportunities and natural resources that are healthy and of high quality. Whether Standard 1.5.2 is capable of ensuring the health and safety of GE food approved for human consumption is questionable. It is also doubtful that FSANZ's current GE food labelling regime gives current generations fair access to opportunities to select food types that are in accordance with their beliefs.

What exactly is the role of FSANZ? This Report identifies two main roles. First, FSANZ protects the public from exposure to certain risks, for instance carcinogens in food. This is analogous to a range of health and safety requirements as diverse as requiring a road worthy certificate, recall of defective consumer products and mandatory workplace safety standards. These requirements exist to protect both users of products and the public in general from risk. They are determined by a raft of factors, among them scientific evidence of risk and the willingness of citizens to have government restrict their freedom. No government in the world restricts its citizens' access to products whose "absolute safety" can be "guaranteed". Rather, governments try to prevent the public from being exposed involuntarily to harmful substances and from choosing to consume substances such as marijuana and narcotics.

The second function of regulatory bodies is to assist consumers to determine for themselves what level of risk is acceptable to them. Products that are high in saturated and transfats, excessive sugar and toxins such as alcohol, nicotine and tar are widely available. However, nutritional and health risk information is required on all such products, and the packaging of alcohol and tobacco products includes health warnings. Thus, potential consumers are provided with information enabling them to choose whether to assume certain risks.

The same may be said for a range of products that may cause harm to the user (or others) if misused. Examples include power tools such as lawnmowers and chainsaws, agricultural chemicals, and prescription and off-the-shelf drugs: in all these cases, consumers are provided with information about the safe use of the products, including restrictions such as consumption while pregnant or driving after consuming the product.

It is evident that some consumers do not follow guidelines for good health and safety. Almost 60% of Australians are overweight, while 26% are clinically obese. Of the over 7000 Australians who died of lung cancer in 2007, half owed their deaths to smoking, as did many stroke and heart attack victims. Alcohol abuse killed and maimed thousands of people, as well as contributing to accidents, violent crime including family violence, and other social costs.

Nonetheless, this Report accepts that if people read and act on product information and advice from government and other health and safety agencies they will not be subjected to unacceptable risk when exercising their choices. It accepts that the FSANZ does an adequate job in protecting the consumer from unknown and unacceptable risks from conventional agriculture. It is not clear that it provides such protection in the case of agricultural involving GEOs.

There are already controversial cases in Australia where GE food has been approved by FSANZ for human consumption despite evidence indicating the possibility of human harm. For example, FSANZ approved Monsanto's insect resistant corn MON 863 for human consumption in 2004. Yet, Monsanto's own tests found that rats feeding on this GE corn variety, developed internal abnormalities, had smaller kidneys and changes in blood composition.

While this test was not made available to FSANZ when it approved the variety, when FSANZ became aware of the test and reviewed the evidence, it concluded that the study did not indicate adverse affects from the consumption of MON 863 corn. Other reviewers are not so confident - the revelations of Monsanto's study "... are certainly sufficient to require an immediate ban of GM maize Mon 863 and all its hybrids from human or animal consumption ... This maize cannot now be considered safe to eat. [The authors] are calling urgently for a moratorium on other approved GMOs while the efficacy of current health testing methods is reassessed."

Despite the contentious nature of the results and conflicts between interpretations, FSANZ did not seek a repeat of the trials by an independent body. It was approved as safe for human consumption in 2002 and is not required to be labeled unless there is novel DNA or protein present in the final food.

Long term animal feeding studies, which give general information about the growth and wellbeing of test animals fed GE foods, are not required by FSANZ's risk-assessment of GE foods. While FSANZ considers long-term animal feeding studies unnecessary, the Public Health Association of Australia disagrees. It has pointed out FSANZ's prior use of such studies and that animal feeding studies are routinely used in nutritional literature as a means to ascertain health effects.

Neither are GE foods routinely tested on humans before entering the marketplace. A review of 12 reports covering 28 crops approved for human consumption by Pryme and Lembocke did not contain any feeding tests on humans. For Pryme and Lembocke,

> It … [is] apparent that GM food regulation is currently based on a series of extremely insufficient guidelines [and that] much more scientific effort and investigation is necessary before we can be satisfied that eating foods containing GM material in the *long term* is not likely to provoke any form of health problems.

The approach of FSANZ is somewhat at odds with this conclusion, as it acknowledges that "… despite the extensive testing of GM foods, their absolute safety cannot be guaranteed."

Indeed, little is known about the long-term effects of consuming GE food compared to other food stuffs both within Australia and abroad. However, evidence of adverse impacts to human health from the production and consuming of GE varieties in the short-term exists. These include allergenic potential and toxicity.

As a short-term impact, allergenic potential of GE varieties can arise from known allergens or allergens hitherto unknown to science. For example, in the case of the former, genes transferred from species known to have allergenic propensity are more likely to express that allergenic property following engineering. Transfer of allergens occurred in the transfer of a Brazil nut gene into soybeans to increase their protein.

Conventionally produced soya bean products are not renowned for their allergenic potential. Yet UK's leading specialist in food sensitivity, York Laboratory, found a 50% increase in soy allergies in the UK in 1998. This finding raised soy in the top 10 allergenic foods for the first time in 17 years of testing, which suggests a potential correlation between GE foods and allergies. Comparative tests between GE and non-GE soy varieties have also illustrated that some individuals can be allergic to one variety only, thus raising questions about assumptions of substantial equivalence used by FSANZ when conducting safety tests.

In India and the Philippines, reactions to the handling of GE varieties have been noted. Twenty-three cases of allergic reactions arising from picking, loading, weighing and separating Bt cotton fibre have been reported in Madhya Pradesh, India. Mild and severe symptoms included itching, skin eruptions, swelling, nasal discharge, sneezing, and lesions.

In the Philippines, allergic reactions, headaches, dizziness, extreme stomach pain, vomiting, chest pains, fever, respiratory, intestinal and skin reactions are thought to have been caused by Bt corn pollen. Most of the 96 people affected in the village of Sitio Kalyong in 2003 are still ill and villages have attributed five unexplained deaths to the Bt corn. Similar reactions were reported in other villages using the same Bt variety.

Further, there is further documented evidence that transgenes can incorporate into saliva and the gastrointestinal tract. Studies on the transfer of GE DNA to human saliva and gut illustrated a potential for transfer, the likelihood of which increases depending on the placement of the GE gene. One of the very few human feeding tests found that genes from GE soy transferred into gut bacteria in three out of seven volunteers. However, the researchers found that transference had occurred prior to the time the feeding studies were undertaken and thus the transgene was stably integrated into the subject. Surprisingly, without any follow-up investigation to support their conclusion, the researchers concluded that the transfer was unlikely to impact on human health.

Children are more exposed to GE ingredients than adults because they are higher consumers of milk and corn products and some soy products. In Australia, many of the foods that are listed as containing GE ingredients are found in the baking section of supermarkets. Given that children and young adults are likely to be the most frequent consumers of sweet baked goods their exposure to GE ingredients is increased further. However it is already effectively impossible to prevent them from being thus exposed, short of banning the sale of all such products.

Children are also more susceptible to toxins and allergens than adults in general. This means that GE food is also more dangerous to children than adults. Concerns have been raised abroad where cows have been engineered to produce milk containing proteins from human milk and destined for premature babies. There is also concern over rice engineered to contain genes involved in producing human breast milk to treat dehydration and diarrhoea in infants. As biologist David Schubert warned

> Since children are the most likely to be adversely effected [sic] by toxins and other dietary problems, if the GM food is given to them without proper testing, they will be the experimental animals. If there are problems, we will probably never know because the cause will not be traceable and many diseases take a very long time to develop.

Unfortunately, potential impacts to human health are not limited to adults, children – or the current generation. “The creation of novel RNA molecules by insertion of DNA into the maize genome could create species of RNA that are harmful to humans, possibly through food … There is also evidence in animal studies that some small RNA molecules can be transmitted through food, causing lasting, *sometimes inheritable*, effects on consumers and their children.”At least one GE corn variety approved for consumption by FSANZ has this feature – LY038, which was approved in 2006.

In Australia, the inherent difficulty of tracing the allergenic, toxic or genetic effects of GE foods is, in part, due to the inadequate labelling system. Contributing to the problem of both avoiding and identifying allergies arises from the narrow labelling requirements in Standard 1.5.2 – labelling is only required where GE foodstuffs are 'substantially different' from its conventional counterparts or where the final food contains novel DNA or protein. Labelling is not required in the case of accidental contamination, or at restaurants and takeaways stores. Where no labelling is required, tracing the origins of the allergenic reaction in individuals is difficult, if not impossible.

The Starlink™ controversy is a well-documented case of contamination of the human food supply with GE crops unintended for human consumption. In 1998, Starlink™ insect resistant corn was approved for animal feed and industrial purposes only in the USA due to concerns of allergies developing. By 2000, it had contaminated the human food supply in the USA, Canada, Egypt, Bolivia, Nicaragua, Japan and South Korea. The cost in the USA alone from the recall of over 300 corn products and from loss of export markets was estimated at $US1 billion. Despite the recalls and subsequently being banned, Starlink™ contamination is ongoing. The Union of Concerned Scientists suggests that "[p]art of the explanation may be that the seed supply for corn is still contaminated... It may be that inbred lines remain contaminated with Starlink genetic sequences and every time these inbreds are used to produce hybrid corn seed, the Starlink sequences are reintroduced into the seed supply."

More worrisome, are cases where biopharmed varieties engineered to produce, for example blood clotting agents'', blood thinners, experimental animal vaccines, industrial enzymes, antibodies, and abortion-inducing compounds cross-contaminate the food supply. Physical contamination of the human food supply with biopharmaceuticals has occurred in the United States where GE maize that contained a pig vaccine unapproved and unintended for human consumption contaminated soya beans. The risks from biopharming to both human health and the environment are greater than that of GE transgenic plants intended for human and/or animal consumption.

Despite the risks, numerous trials for the creation of such products are underway in Nebraska, Hawaii, Puerto Rico, Wisconsin, Iowa, Florida, Illinois, Texas, California, Maryland, Kentucky, and Indiana. In Australia, there are no current trials or commercially released crops with these attributes. However, the GTA does not prohibit the creation of biopharmaceuticals and there are no policy principles in existence to that effect and, consequently, there is potential for biopharmaceuticals to be grown in Australia. Evidence suggests that Australia is on the way to this reality - in 2001 a licence to trial GE oilseed poppy engineered for increased alkaloid expression and an antibiotic marker gene was granted. CSIRO scientists have also recently expressed their desire to genetically engineer oilseed crops such as safflower to create super-lubricants, adhesives, sensors, antibacterials and stretch-Kevlar. Given the focus of the GTA to minimise rather than prevent contamination, and FSANZ standards that allow up to 1% of accidental contamination without labelling, the threat of biopharmaceuticals to the wellbeing of human, animal and environmental health, means that the environmental release of this type of GEO is unjustifiable under the principles of ESD.

With questions being raised about the ability of FSANZ's approval process, the safety of GE foods, and cases from around the world of adverse human health impact from both handling and consumption of GE products, there remains the potential for GE foods to impact on the health and safety of both current and future generations. Due to this, it is doubtful that the current regulatory regime governing the introduction of GE food ensures that both current and future generations have access to natural resources that are healthy and of high quality. This is especially the case when you take into account the high potential of contamination of non-GE varieties with engineered genes, as discussed in Part 3.3.1. Moreover, at least for crops that have engineered varieties, such as soya, canola and cotton, this potential for contamination hinders the ability of individuals of either current or future generations to avoid GE foodstuffs by purchasing non-engineered varieties. In some cases, such as soya products, such persons may need to purchase organic or biodynamic produce, in order to increase the chance of avoiding cross-contamination. For some people, higher retail costs of organic or biodynamic produce make this choice economically unviable. For those wishing to avoid GE foodstuffs entirely, fair and equal access to opportunities to purchase foodstuffs that are healthy and of high quality is curtailed.

3.2.1. The Notion of 'Adequate Food' and the Labelling of GE Foodstuffs

It is clear that the human right to food implied in the social tier of ESD goes beyond nutritional and safety considerations. Special Rapporteur Asbjorn Eide's *Report on the Right to Adequate Food as a Human Right*, emphasised that the core content of the human right to *adequate* food includes, *inter alia*, safety issues, that the food should accessible in ways that are sustainable and that do not interfere with the enjoyment of other human rights. Foodstuffs must also be acceptable within a given culture. When determining whether foodstuffs are acceptable to a given culture, non-nutrient based cultural values attached to food and food consumption must be taken into account as far as is possible. This requires consumers to be adequately informed as to the nature of accessible food supplies.

Despite the requirements of the human right to *adequate* food and its relevance to ESD in agriculture, FSANZ does not consider whether a GE foodstuff is 'adequate' above and beyond its nutritional content, toxicity, allergenic propensity and human health considerations. FSANZ does not take into account any ethical, social or religious matters when making a determination on the entrance of GE organisms into the food chain.

Indeed, FSANZ repeats throughout applications for the approval of GE food that such concerns are outside its jurisdiction, and, in the case of Maori concerns, uses a standard form response. Even so, concerns regarding these matters have been raised repeatedly in nearly every public submission on the proposed release of a GEO into the food chain, which indicates the level of consumer interest in the issue.

This suggests that cl 7 (e) in Standard 1.5.2 is there merely to appease public concern, as the degree to which ethical, social or religious concerns are taken into account *in practice* is far from 'adequate' and certainly less than what is possible. According to the NSW Food Authority, food producers are under a legal obligation of due diligence, which means they are required to know about the ethical, cultural or religious objections that may arise in regards to their foodstuff and to label them *if the producer deems them significant*. However, there is no accepted interpretation of the word ‘significant’, and according to the NSW Food Authority, the interpretation of ‘significant’ is left to the standard dictionary definition, again, *as interpreted by the producers.*

The failure of FSANZ to even consider these legitimate public concerns and to delegate them to the subjective interpretation of producers does not acknowledge the public and personal significance of non-nutrient based cultural, social and religious values attached to food. This situation is far from satisfactory and means that FSANZ’s claim that "... the purpose of labelling is simply to provide information to consumers, allowing them to purchase or avoid GM foods depending on their own views and beliefs" is questionable. It is also contrary to the human right to food implicit in the social tier of ESD and the requirement that, to be acceptable, non-nutrient based cultural values attached to food should be considered.

Moreover, the failure of the approval process to consider ethical, cultural and religious concerns circumvents the degree to which community involvement in decision-making is possible. This is the case under the approval process of both FSANZ and the GTR. Like FSANZ, the GTR will consider verifiable scientific evidence only when coming to a determination. In the case of intentional environmental release of GEOs, public comment is invited only where the GTR considers the release could pose a significant risk to human health and safety and the environment. The public may comment on scientific matters only regarding issues relating to potential risks to human health and the environment. Like the situation with the approval of GE foodstuffs, other matters such as ethical, religious or cultural concerns are deemed ‘OSA’ – ‘Outside of the Act’. So, while the GTR notes the importance of taking ethical issues into the decision-making process, in practice, socio-economic risks, ecological, ethical and cultural values are not considered in the approval process. This is clearly contrary to the goal of ESD in agriculture to take into account the social impacts on present or future generations from the use of GEOs.

Given that the majority of commercial GE crops are intended, at least in part, to enter the food chain and the importance of such issues as to the right to food, failure to consider such matters is a considerable shortcoming of the GTA’s assessment process. It is no wonder that, where public input has been invited, such as in the case of the release of InVigor® canola, submitters have felt that their concerns have been ignored and that participation in the process is not worthwhile. Accordingly, both the GTR and FSANZ’s approval process does not allow for the ‘extensive community input’ envisaged in the social tier of ESD.

Cultural, social and religious concerns are also somewhat disregarded in the enforcement of Standard 1.5.2. The NSW Food Authority only considers a breach of cl 7 (e) Standard 1.5.2 to have potentially occurred in *applied* cases of ethical, religious or cultural concerns, such as Jewish and Muslim objection to the consumption of pork. So, if a GE food contained pig genes and the food product was not labelled, then enforcement of Standard 1.5.2 could ensue.

But many people are opposed to GE on principle, including vegans, adherents to different religious/spiritual beliefs and environmentalists. Objection to GE on the basis of principle, or faith, is often based on the belief that by genetically engineering life, we are ‘playing god’ or, in the case of indigenous practitioners, because often the engineered plant/animal plays a fundamental role in their belief structure. Principled objection for some environmentalists is often on the basis that GE treats nature purely as a means to an end, and is thus against the notion of the intrinsic value of life. For vegans it is not acceptable to eat or even wear animal products *at all* - and this includes genes derived from them.

None of this is meant to suggest that the beliefs of what may be very small minorities should determine public policy. For example, Jews and Muslims do not eat pork, but they don't believe that other people should not be allowed to eat pork. But of course they should have the right to receive information about the potentially offensive content of food. However, it is doubtful that labelling of GE foodstuffs that is offensive in principle, rather than in an applied case, is even required by cl 7 (e) Standard 1.5.2. NSW Food Authority certainly has does not consider a breach of that clause to have occurred in such a case. Thus, a person who was opposed to the release of a GE foodstuff because it was 'against nature' would have no avenue through which to express their objection and would not know which foods contained the offending GE ingredient. Consequently, people who oppose GE foodstuffs on the basis of principle are unable to exercise their right to freedom of choice unless they undertake the rather arduous task of working out for themselves what food does or does not contain GE ingredients. This may prove impossible in many circumstances. For example, while it is possible for consumers to avoid purchasing GE cotton garments, either by buying products labelled organic by not buying cotton products at all, it is effectively impossible to purchase non GEO mass-produced baked goods that include soy as an ingredient.

Indeed, as we have noted, people are able to exercise their freedom of choice in the case of GE food only where it is deemed to be 'substantially different' from its conventional counterparts or where the final food contains novel DNA, the latter of which is again a decision left to industry to determine. Given that only one GE ingredient out of thirty approved for release by FSANZ is deemed 'substantially different' by the authority and is required to be labelled, it is clear that the current regime fails to enable~~s~~ people to exercise their freedom of choice.

Freedom to choose foodstuffs that are acceptable on both applied and principled ethical, cultural or religious grounds, and on the basis of perceived health concerns is impossible in the case of foodstuffs derived from animals that have been fed on GE ingredients, because Standard 1.5.2 does not require these to be labelled. A recent investigation undertaken by the *Herald Sun* found that cows producing milk products sold in Australia were consuming up to 5% of GE cottonseed, canola and soy meal.

This issue is of particular relevance to the Nambucca Shire. Where fed grain and meal, animals grown in the Nambucca Shire largely consume feed containing GE ingredients. An investigation in 2007 into the type of feedstock sold in the shire that contains GEOs, found that three of the main suppliers of stock feed for cattle, horse, pig and chicken situated in the Nambucca Shire - Norco, Welsh Stockfeeds, and Mitre 10 - sell only bagged stock feed that contains GE ingredients. Indeed, only one producer of horse food that is distributed in the Shire – CopRice – does not currently contain GE ingredients as it sources its soybean meal within Australia. Cargill, the supplier of stock feed to BEC Feed Solutions distributes to locally owned *Welsh Stockfeeds* which distributes feed containing Australian GE cotton meal and GE soybean meal imported from South America and the USA. *Norco*, mainly distributes the brand Riverina (goat, cow, pig and chicken food), which contains Australian GE cotton meal and US GE soybean meal. The amount present varies monthly as each formula is reviewed monthly. The most common ingredient is Australian sourced cottonseed meal and imported soybean meal. With the lifting of NSW and Victorian moratoria on GE canola early 2008, the amount of GE canola in stock feed is likely to increase as all suppliers or distributers questioned indicated that the canola was sourced from Australia and that the moratoria had ensured the integrity of the supply.

In summary: the labelling of GE foodstuffs in general under Standard 1.5.2, and particularly in the case of labelling on the grounds of ethical, cultural or religious concerns is far from adequate. As a result, it is questionable whether consumers are adequately informed about the nature of food supplies, especially where such foods are ethically, culturally or religiously offensive. This situation is not only contrary to what is required under the social aspect of ESD, it is contrary to that required under the international law of human rights.

3.2.2. The Environmental Aspect of the Social Tier of ESD.

Due to the interconnections between the core and guiding principles of ESD, the social tier necessarily includes an environmental component. For the sake of brevity, and based on the arguments above, it is sufficient to conclude that the current regulatory regime found in the GTA and GE crops in general fails to satisfy the ESD goal of the promotion of the ecological integrity of the receiving environment. Indeed, the risk focused approach and the separation of socio-economic issues indicates a trend away from such holism and tends to reinforce the view of the separation of humans from nature. While the social component of ESD, both in agriculture and in general, makes clear that the current generation should choose a development path that promotes genetic and ecosystem diversity, ecological integrity and environmental productivity, GE falls well short of supporting these values and goals. Indeed, given the real potential for GE varieties to cross contaminate both agricultural and non-agricultural species and varieties, create ‘super-weeds’, pollute soil and water, upset ecological balance and lead to a decline in genetic diversity, GE threatens to leave future generations massive environmental debt and a legacy of environmental destabilization.

3.3. ESD in Agriculture: Economics and GE

3.3.1. GE, GTA: Segregation and Unintended Presence

According to the principles of ESD in agriculture, *viable* economic development requires a contribution to both society and our environment that is overall positive, and therefore both positive and negative impacts on the wider community must be taken into consideration in the decision-making process. Yet, the GTR has noted on numerous occasions that social, environmental, economic, ethical or political issues, positive or otherwise, are outside of assessments conducted under the GTA. Agricultural benefits are outside of the Act as are segregation and unintended presence concerns, market viability, herbicide use and economic issues, labelling concerns, and general social, economic, ethical and political concerns. To clarify further:

> Economic impacts, such as the costs of crop segregation for marketing purposes and generally, risks to agricultural production and sustainability of farming systems do not come within the definition of the term environment in the Act. Accordingly, when considering this application, [the GTR] approached the task of identifying risks posed by or as a result of gene technology on the basis that it does not cover economic matters such as the national or regional or sectoral economies or markets. Further, [the GTR] approached the process on the basis that it [did] not require [her] to identify risks relating solely to the monetary costs of gene technology for individuals or groups of farmers.

Despite the inability of the GTR to consider issues of segregation when determining an application for the environmental release of GE crops, segregation is a prevalent concern for many non-GE farmers and the wider community. This is not surprising given that a report by the Australian Bureau of Resource Economics (ABARE) illustrates that the costs of segregation will be borne by non-GE farmers. The report estimates that negative impacts from crop segregation to non-GE farmers will be between 5 - 15% of the farm gate value of their crops.

With regards to GE canola, segregation costs are unavoidable if famers are to market varieties as GE free to meet consumer demand and if they are to comply with worldwide labelling standards. Not surprisingly, segregation costs will increase canola prices in Western Australia by between 5-9%. For organic canola, honey and beef "the potential impacts of approved GM canola … are that meeting a zero tolerance criteria [sic] may be costly or impossible for some producers ..." Yet, without identity preservation arrangements, "... widespread commercial release [of GE canola] in Australia may not be justified ..."

A comprehensive analysis of the cost implications of sourcing non-GE varieties of soybeans, maize, cotton and oilseed rape (canola) was undertaken for the European food chain for. The analysis found that the supply chain bore most of the costs associated with the use of certified non-GE raw materials. Depending on the type of segregation and identity preservation system in place, the price differential between GE varieties and non-GE soy ranged from 4- 10%, and in the case of maize the price differential was estimated at 3 -4% . This additional cost is passed on to retailers, and ultimately, consumers.

For some products, an increase in costs was deemed unsustainable unless they shifted to consumers willing to pay price premiums. Insofar as increased production costs are shifted to consumers, there is potential for the human right to adequate food to be adversely impacted by such premiums where the price increase impacts on the ability of individuals to purchase food for a price that does not impinge on other basic needs and is socially and culturally acceptable to the individual.

The need for segregation and associated costs is further at odds with the ESD in agriculture principle of diversity and flexibility within economic systems. For diversity and flexibility to flourish competition between growing systems, is needed, which in turn requires different growing systems to be economically viable and capable of differentiation. This is achievable only if physical and genetic segregation is possible. As the current regulatory regime stands, even where no unforeseen problems emerge, introducing GE strains into a system means that no account of regional differences and changing economic, environmental and social factors is possible. At least in the case of GE commodities, systems become rigid and thus flexibility within economic policies becomes unachievable.

Thus, without the GTR considering any positive *or* negative impacts on national, regional or sectoral issues or general environmental, social and ethical issues arising from the release of GEOs, it is impossible to conclude that the use of GE in agriculture is a *viable* economic development that contributes positively to both society and our environment.

3.3.2. Liability for Contamination of Non-GE Varieties with Engineered Genes.

There is no statutorily created liability regime governing the losses arising out of accidental physical or genetic contamination of organic or non-GE crops - the common laws of nuisance, trespass and negligence are considered by the Australian government to be adequate to deal with contamination issues. However, a further government funded paper on liability for genetic contamination indicates that the laws of nuisance, trespass and negligence are far from adequate for dealing with the issue. Rather than adhere to the 'polluter pays' principle of ESD, which requires the full costs of production to be borne by the growers of GE goods, liability for genetic contamination is distributed throughout the supply chain - non-GE and organic farmers, transporters and harvesters, bulk handlers and manufacturers and retailers assume liability.

> [W]here the unintended presence of GMOs occurs despite all those involved in the GM supply chain complying with all relevant requirements and guidelines, it is possible for those affected by the unintended presence to bear all the associated costs. Similarly, where the precise source of the GMO cannot be ascertained, farmers affected by unintended presence will have difficulty identifying the party responsible and thus may have no legal redress to obtain compensation for any loss occurred.

Third parties whose crops are contaminated with engineered genes may also be liable under the GTA. Where a farmer knows his/her crop has been contaminated - for instance, where crops display tolerance to herbicides - and continues to grow those crops, they could be found to be in breach of the GTA. Similarly, even where offending crops are destroyed, the lingering presence of GE seeds in the soil could imply knowledge and therefore liability on a farmer.

However, where contamination occurs through failure to comply with the GTA or associated Regulations, a licence holder may be ordered to take reasonable steps to comply with the legislation. Failure to comply with an order can result in the licence holder becoming liable to the Commonwealth for any costs incurred to remedy the breach. Where contamination occurs despite licence conditions being complied with, the licence holder will not be liable for remediation costs.

There have already been instances of contamination of non-GE canola in Western Australia and Victoria. These are not isolated events: the non-governmental *GE Contamination Register,* jointly maintained by *Gene Watch UK* and *Greenpeace International,* notes a total of 216 cases of contamination or resistance worldwide since 2000. Of those, eight cases of contamination from both approved and unapproved GE and one case of insect resistance to Bt toxins occurred in Australia. Contamination was the result of human error, cross-pollination, failure of segregation programmes and imported seed. Given the inherent impossibility of preventing the dispersal of DNA, it is fair to assume that many more cases of unintentional contamination remain unreported.

It is also clear from the situation in Canada that genetic pollution can become so prevalent that growing organic or conventional strains of crops such as canola is a practical impossibility. It is no wonder that the GTA has been called

> ... legitimating [sic] mechanism for rampant genetic pollution. The impact of this on organic and conventional farmers will undoubtedly be significant, and possibly catastrophic.

It was for Percy Schmeiser. Mr Schmeiser found stains of canola growing on his land that survived being sprayed with the herbicide, Roundup Ready. Mr Schmeiser saved and planted this canola seed. The canola was later found to be Monsanto's patented variety, "Roundup Ready" canola, for which Mr Schmeiser did not have a licence to grow. Monsanto commenced court proceedings against Mr Schmeiser for patent infringement. In 2004, the majority of the Supreme Court of Canada found that use of the canola plant corresponded with use of the gene. Therefore in growing the canola plant without licence to do so, Mr Schmeiser had 'used' the patented cell and gene, and had therefore breached Monsanto's patents.

Whether the legal situation in Australia will follow the Canadian case of *Percy Schmeiser & Anor v Monsanto Canada Inc & Ors* is yet to be determined. However, given the similarities between the Canadian *Patents Act 1985* and the Commonwealth *Patents Act 1990* it is likely that the principles arising from the *Monsanto* case would be applicable in Australia. Mr Schmeiser was found to breach Monsanto's patents even though it was unknown how Monsanto's canola came to be growing in Mr Schmeiser's fields – it could have arrived on Mr Schmeiser's land by escaping from passing trucks, or through natural pollination. As well as flouting principles of natural justice, this situation appears to be inconsistent with aspects of ESD. The first Core Objective is "To enhance individual and community well-being and welfare" whereas the result of the case seems more likely to enrich companies such as Monsanto at the expense of famers such as Mr Schmeiser. This result is clearly inequitable, and therefore in breach of ESD Guiding Principle (iv), "decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations". Given that it effectively imposes financial penalties on non-GE farmers, it is also in breach of Principle (iv), the need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised and (v) the need to maintain and enhance international competitiveness in an environmentally sound manner.

The economic component of ESD in agriculture indicates a trend towards holism and integration, and the creation of a diverse range of economic opportunities that are environmentally sound. The current GE regime and its failure to take into account the impacts on non-GE and alternative farmers come in conflict with the principle of economic diversification. Should genetic pollution occur and subsequently, non-GE and alternative farmers lose markets and the ability to produce the crops they desire to grow, then there is some potential for primary producers to be confined to engineered varieties and thus a narrowing of both agricultural genetic diversity and practices to occur.

Moreover, passing liability and associated costs along means that the full costs of production are not borne by growers of GE goods and thus their goods' environmental impact is incapable of being accurately reflected in the pricing thereof. It thus breaches the Polluter pays Principle discussed earlier. Further, pricing of GE goods in general does not reflect the potential environmental impacts discussed in part 3.1 above.

3.3.3. The Viability of GE in Agriculture – Economically Beneficial?

One of the factors motivating the adoption of GE varieties by farmers is the perception that compared to conventional varieties, GE crops have a higher yield and reduced production costs and are thus more economically viable. However, research produces conflicting results which indicates that a blanket statement regarding increased yield of GE crops is unsubstantiated. For example, in 1998 report illustrated a Roundup Ready soybean varieties produced 6.7% less than their conventional counterparts and, when compared to high-yielding conventional crops, US herbicide tolerant soybeans have also displayed a decrease in yield by 4 - 20%.

Comparative analysis of the economic and environmental impacts of GEOs illustrated little economic benefit for Australian cotton farmers. No increase in yield was noted and technology fees were substantial. For example, while analysis of the economic impact of GE cotton in Australia indicates a saving of AU$50 – AU$250 for HR and IR cotton respectively, these returns are largely offset by substantial technology fees. Licensing fees for HR and IR cotton in Australia are around AU$79 and AU$396ha respectively. In the case of smaller agricultural holdings, such as those found in the Nambucca Shire, these technology fees may mean that adoption of GE varieties is unviable.

According to the principles of ESD, the use of genetic engineering in agriculture should promote a flexible, integrative and viable economic development that contributes positively to society and the environment, yet, without co-existence, this is not possible. Moreover, without the GTR considering the economic impacts, including the costs of segregation, and the risks to agricultural production and sustainability of farming systems, the current regulatory process governing the environmental release of GEOs does not provide for a means by which to ascertain whether such release is in the best economic interests of both a locality, and Australia in general. Neither does the regulatory process include consideration of the full-costs of production, including the environmental costs of genetic engineering. According to the principles of ESD, users of genetic engineering should pay the actual cost of the full life-cycle of natural resources, but this again, is not required. Thus, in the case of the intentional environmental release of GEOs the principles of ESD in agriculture are not satisfied.

Part 4

4.0. Organic Agriculture in Australia.

The *National Standard for Organic and Bio-dynamic Produce* defines something as "organic or biodynamic" where its practices stress:

- Use of renewable resources; and
  - Conservation of energy, soil and water; and
  - Recognition of livestock welfare needs; and
  - Environmental maintenance and enhancement, while producing optimum quantities of produce without the use of artificial fertiliser or synthetic chemicals.

In addition to these practices, biodynamic agriculture requires

> … the application of preparations indicated by Rudolf Steiner and subsequent developments for management derived from practical application, experience and research based on these preparations.

Since the arrival of commercial organic agriculture to Australia in the middle of the 20th century, it has developed into the fastest growing food sector in the world with global sales for 2006 estimated worth more than EU30 billion (AU$47.4 billion). In Australia, forecast annual growth rates for the industry are between 10% – 30%, with recent figures illustrating that the organic and biodynamic industry in Australia increased by 19% during 2002 and 2006. In Australia, the estimated farm gate value for organic/biodynamic produce ranges from $140.7 million - $250 million in 2003 and increasing to an estimated value of $400 million in 2006.

Australia has the largest certified organic landmass in the world. Reflecting the growth in demand for organic produce, the total amount of land certified for organic production in Australia increased from an estimated 7.9 million hectares in 2003 to between an estimated 11.8 - 12.3 million hectares in 2006. Organic/biodynamic production, organic/biodynamic processing and marketing facilities in Australia have also increased from approximately 2,340 (2003) to 2, 567 in 2006. Of the estimated 2006 figure, an estimated 1691 are farms, of which are located in NSW - more than any other state.

With an estimated 166 certified growers in the Mid North Coast (MNC) in 2005, the area produces a diverse supply of organic/biodynamic products. In 2004, certified farms in the MNC produced:

- 70, 000 kg of live weight beef;
- Just under 20, 000kg of chickens;
- 15, 000 kg of eggs;
- 32, 000 kg of fruit;
- 30, 000 kg of garlic;
- Just under 30, 000 kg of vegetable;
- 60, 000 kg of hay;
- Just under 10, 000 kg of nuts;
- Just under 2, 000 litres/kgs of essential oils/bush foods; and
- 900, 000 litres of milk.

In 2005, there were an estimated 25 certified organic/biodynamic producers in the Nambucca Shire. Those farms produced a range of goods including bananas, seasonal vegetables, mixed fruit, Russian garlic, mulch hay, beef cattle, tea tree, herbs, macadamia nuts, pumpkin, watermelon, avocado, mango, tomato, lychees, and eggs. Organic beef equated to 21% of the industry in Nambucca.

As of 2005, there were at least 320 ha of certified or in-conversion organic/biodynamic land in the Nambucca Shire. While the overall figure may appear small, of the survey responses, the Nambucca Shire ranked second highest of all local government areas in the MNC for the amount of certified or in-conversion organic/biodynamic land. A further 44 farms, 5 processors and 1 input manufacturer are within a 150km radius of the Nambucca Shire.

4.1. The Australian Organic and Biodynamic Regulatory Regime.

In Australia, organic/biodynamic products destined for export are subject to a co-regulatory system between the Federal Government and accredited organisations. The Australian Quarantine and Inspection Service (AQIS) administer the three documents of the scheme: the Export Control (Organic Produce Certification) Orders 2005, AQIS Administrative Orders and the National Standard for Organic and Biodynamic Produce (“the National Standard”). To ensure compliance with these laws and standards and the requirements of importing countries, accredited organisations are subject to audit by AQIS.

As prescribed in the Export Control (Organic Produce Certification) Orders 2005, private organisations may be approved to certify produce as organic/biodynamic for export purposes and to make necessary inspections of farms, processors, wholesalers, transporters, exporters and in some circumstances domestic retailers. To successfully gain accreditation, applicants must be operating a Quality Management system (QMS) that ensures organic/biodynamic produce conforms to trade descriptions and complies with the requirements of importing countries and have a compliant Quality Management Manual in place.

Further, approved organisations must maintain a documented system that is consistent with AQIS’s Administrative Arrangements (AA). AAs specify administrative polices and operational procedures for accredited organisations, which include objectivity and integrity, structure and training, sanction and penalties, inspection and certification procedures, and export and import requirements. Further, AAs stipulate matters to be considered in audits of certified operators. After accreditation, AQIS undertakes at least one initial audit of the accreditation organisation to determine compliance with relevant laws, consistency between the AA, the QMS, the National Standard, and importing country's requirements. Thereafter, AQIS undertakes yearly audits, to ensure compliance continues.

Certified organisations grant Organic Produce Certificates (OPC). OPCs describe the type and quantity of the produce and certify that the production and preparation of the produce complies with the importing requirements for organic/biodynamic goods of the importing country. A certified organisation may grant an OPC to an applicant if the produce has been subject to and produced and/or prepared in accordance with, the certification organisation's quality management system and the produce and preparation thereof satisfies the importing country's requirements. No produce can be exported from Australia as organic or biodynamic without an OPC.

Certification of organic/biodynamic producers, processors, wholesalers, retailers, and importers is granted by seven bodies accredited to certify products by the AQIS. The accredited organisations are as follows:

- Australian Certified Organic (ACO – subsidiary of BFA);
- Bio-Dynamic Research Institute (Demeter label) (BRI);
- National Association for Sustainable Agriculture Australia LTD (NASAA);
- Organic Food Chain of Australia (OFC);
- Organic Growers of Australia (OGA – subsidiary of BFA);
- Safe Food Production Queensland (SFPQ);
- Tasmanian Organic-dynamic Producers (TOP).
- AUS-QUAL Limited.

ACO/BFA and NASAA certify all sectors of organic *and* biodynamics including production, processing, wholesaling and retailing. These certifiers are further accredited to three different international and foreign standards - the International Federation of Organic Agriculture Movements (IFOAM), the Japan Agricultural Standard (JAS) and the US National Organic Program, developed by the US Department of Agriculture (USDA). BFA, OFC, SFPQ, TOP are more specific in their certification – for example, BRI certifies biodynamic produce only from paddock to plate. TOP largely restricts itself to certifying organic/biodynamic producers and manufactures in Tasmania. In addition to organic certification, AUS-QUAL includes other Food Safety Programs in the certification and licensing agreement.

4.2. The National Standard for Organic and Bio-dynamic Produce (2007).

The National Standard provides the minimum requirements for products that are labelled as, or implied to be, produced using organic/biodynamic methods and that *are intended for export.* There is no Australian Standard governing organic/biodynamic produce intended for market in Australia. However, to ensure quality and integrity of produce marketed as organic /biodynamic, the industry has adopted the National Standard as a minimum de facto standard governing organic produce sold in Australia.

The National Standard has a wide and encompassing ambit and contains a substantial list of principles and standards that govern all aspects of organic and biodynamic farming, including, for example, production, environmental management, livestock, aquaculture, transport, labelling, retail, wholesale and export. The general principles guiding organic/biodynamic production emphasise the enhancement of sustainability of natural agricultural resources and the production of optimum quantities of produce with high nutritional value.

Reflecting the holistic approach of organic/biodynamic farming, farm management practices contained in the National Standard seek to co-exist with and protect the environment and enhance sustainability of natural (including biological) systems. According to the National Standard, this is to be achieved through an integrated approach that maintains or improves soil fertility, avoids pollution, and minimises use of non-renewable energy. Moreover, livestock are treated in a manner that reflects behavioural needs, such as natural copulation and birth, and in a way consistent with animal welfare. According to the National Standard, crops that are suited to local and regional conditions, with disease resistance, sound nutritional and physiological quality and that come from organic seed or plant propagation material should be selected. This allows for mutually beneficial relationships and co-evolution between species to develop.

4.3. Organic Status and Labelling of Organic/Biodynamic Goods in Australia.

Land intended to be used to grow certified organic/biodynamic produce and livestock must go through a conversion period whereby the practices contained in the National Standard are implemented. Land is deemed ‘in-conversion’ after adhering to those practices and principles for at least a year. After two years, produce grown on in-conversion land may be sold and labelled as ‘in-conversion’ organic/biodynamic produce if the requirements of the National Standard are met and if the goods are prepared or produced by an operator certified by a recognised certification organisation.

After 3 years, such land gains full certified organic/biodynamic status if, in addition, quality standards such as soil structure and the farm management system are sufficiently developed to maintain ongoing production. After these criterions are satisfied, full labelling rights are gained.

Labelling of in-conversion or fully certified organic/biodynamic products must clearly show that the claims relate to the method of production and must be labelled according to the amount of organic/biodynamic produce contained in the final product. Labelling must also include the operator’s address or certified number, the certifying organisation’s name, address or authorised logo/trademark and comply with other labelling requirements under Commonwealth or State/Territory law.

Products sold, labelled or represented to be 100% organic/biodynamic must use only products produced and processed in accordance with the National Standard. Where goods are labelled as ‘in-conversion’ organic/biodynamic produce, ingredients must be sourced from in-conversion operators. Products that do not contain 100% organic/biodynamic produce can still be sold, labelled or represented to be organic/biodynamic if they contain at least 95% organic/biodynamic produce. Non-organic/biodynamic ingredients must have an agricultural origin and in the case of additives and processing aids, must be permitted by the National Standard. These two requirements further apply in the case of produce made with at least 70% organic/biodynamic ingredients. Where satisfied, such foodstuffs may be labelled as ‘made with’ organic/biodynamic ingredients if the ingredients are produced by certified operators.

Products containing less than 70% organic/biodynamic ingredients cannot be labelled as organic/biodynamic. However, reference to the inclusion of the organic/biodynamic ingredient can appear on the ingredient list. The name and relative level of the organic/biodynamic ingredient must be in descending order on that list and the wording must be of the same nature and style as the non-organic/biodynamic ingredients. Inclusion of reference to a certification organisation may only be use in conjunction with the certified ingredient.

The National Standard also contains strict provisions with regards to GEOs and prohibits ingredients or components derived from GEOs from being labelled organic/biodynamic. Where contamination is known to have occurred between GE and organic/biodynamic produce, the organic/biodynamic produce must be excluded from sale. Land upon which GEOs have previously been grown or raised cannot be certified until 5 years after the date it was used for that purpose. No animals, seed or farm inputs derived from GE technology or its derivates, transgenic plants or substances or livestock vaccines derived from biotechnology are permitted to be used by organic and biodynamic farmers.

Part 5

5.0. ESD of Organic Agriculture: Environmental Considerations.

The general scientific consensus is that organic agriculture is more environmentally friendly than conventional agriculture both in absolute and relative terms. However, many of the studies covering the environmental effects of organic/biodynamic agriculture are from the Northern hemisphere. Australian scientific studies on organic/biodynamic agriculture are rare and are non-existent for the Mid-North Coast (MNC) and the Nambucca Shire. Accordingly, while these studies demonstrate consistency between organic/biodynamic agriculture and the environmental goals of ESD and illustrate potential for a similar outcome to occur in Australia, they cannot be taken as direct evidence of the environmental sustainability of organic/biodynamic agriculture in Australia. In absence of such studies, it cannot be determined whether Australian organic/biodynamic agriculture is consistent with the ESD in agriculture goal of protecting and maintaining biological diversity and life support systems *in a manner suited to the local region.*

5.1. Conservation of Soil and Water.

The maintenance and improvement of soil structure, fertility and nutrient recycling are key to any organic or biodynamic growing system and contribute significantly to the health of the ecosystem as a whole and the nutritional value of produce derived from it: organic/biodynamic agriculture recognises soil as the primary life support system. Accordingly, the National Standard requires organic matter such as legumes, green and animal manure and perennial deep-rooting plants to be returned to the soil to help improve or maintain humus levels.

Extensive studies abroad have illustrated that soil organic matter, acidity and pH levels, soil structure, soil fertility and stability tend to be higher in organic than conventional agricultural systems. The reliance on animal manure and legume green mature crops has been shown to reduce carbon and nitrogen losses from the soil to increase active and stable soil organic matter. European studies on soil carbon content have also illustrated a tendency for organic farming to have higher carbon levels than conventional systems. Physical fertility does however depend on the particular organic matter(s) used and the degree of tillage employed with the original fertility level of the soil playing a role. The use of composted manure in organic and biodynamic systems also helps avoid soil acidification and is necessary to increase soil biological communities. Given that the National Standard recognises soil as a primary life support system and promotes its development, organic agriculture in Australia is likely to be consistent the ESD principle of maintaining or increasing life support systems.

A comparative study on the erosion rates on conventional and organic farms found considerably deeper topsoil, higher organic matter content and less soil erosion on organic farms compared to their conventional counterparts. Increased soil structure has been noted to reduce soil erosion - organic farms have a high water infiltration and retention capacity. Moreover, organic systems tend to restore degraded soils, remediate the effects of erosion, and have less nutrients and sediment enter waterways. Consequently, on organic farms, the impacts of flooding, deterioration of water quality from nitrate and phosphate leaching, sediment flow, and silting of rivers, streams and reservoirs are reduced. This is of importance to the Nambucca Shire, which has an intricate river and estuary system.

Water management on organic and biodynamic farms, is according to the National Standard, integral to a properly functioning organic or biodynamic farming system. Water management includes management of vegetation, soil and drainage and includes water recycling systems. With increased potential for drought and flooding to occur in the MNC due to the effects of climate change, the adoption of appropriate water management techniques will be instrumental to maintaining economic, social and environmental stability within the region. Higher organic content allows for increased water-holding capacity including groundwater recharge and decreased runoff, with heavy loess soils in temperate climates showing 20 – 40% more capacity than conventional plots. Increased water retention capacity is beneficial in periods of drought, such as occurred in Pennsylvania where organic corn yields were 28 to 34 % higher than conventional corn harvests. Organic systems also have less need to irrigate than in conventional systems and in India, biodynamic soils has been shown to decrease irrigation needs by 30 to 50 percent.

Proper water management includes managing water in a way that allows for the needs of the farm and local ecosystems to be maintained and thus provision must be made for the maintenance of riverine health, wetlands and biodiversity. Substantiated by scientific evidence from abroad, provisions of the National Standard concerning soil and water are consistent with the ESD in agriculture principle of protecting and maintaining life support systems. As discussed below, protection and maintenance of these systems is enhanced by avoidance of pollution and protection of natural habitats.

5.1.2 Minimisation of Inputs and Avoidance of Pollution

The practices espoused by the National Standard and the philosophy underpinning it go beyond the requirements of the precautionary principle included in ESD. The National Standard identifies the avoidance of pollution in agricultural practices as a principle objective and to this end prohibits certain inputs, including synthetic chemicals including pesticides and herbicides and GEOs. Therefore adverse onsite and offsite impacts are prevented.

The National Standard recognises that use of any off-farm input carries with it the potential to invite unwanted pests into the receiving environment, to be misused and to alter the soil, water ecosystems and the farming environment. It thus discourages high or routine use of off-farm inputs and only permits the use listed inputs such as animal manure, Epson salt and wood ash. Further, the National Standard emphasises the need to conserve energy through the importance of minimising the use of non-renewable resources and by working within a closed system as far as is possible.

The National Standard also prohibits the use of synthetic agricultural pesticides for the control of pests and diseases. Rather, this is to be achieved through management techniques such as biological control, crop rotation, traps, barriers, light, sound and the grazing of livestock. The use of such alternative control methods have resulted in a general consensus that organic agriculture tends to avoid water contamination and air pollution caused by synthetic pesticides.

However, the National Standard allows for limited use of approved pesticides derived from natural sources such as rotenone, copper and natural pyrethroids. In Europe, no water contamination from these substances has been reported. Indeed,

> … a threat to water quality by the pesticides permitted in organic farming cannot be assumed. Together with the fact of the complete absence of synthetic pesticides … a conclusive assessment of organic farming with respect to the environmental indicator 'contamination of water by pesticides' has to be rated as highly superior as compared to conventional farming.

The absence of chemical pesticides and synthetic fertilizers in organic/biodynamic farming has been noted as one of the primary ways of increasing farmland wildlife. This feature of organic/biodynamic farming is thus consistent with the ESD in agriculture objective of maintaining or enhancing biodiversity and protecting and restoring the natural resource base.

The use of synthetic fertilisers and pesticides has been shown to pollute groundwater, the pollution of which is of considerable concern due to the persistence of these contaminants. Diffuse pesticide contamination has been detected in 20% of Australian aquifers that are situated below intensively cropped land. Nitrate pollution is the most significant diffuse contaminant of groundwater in Australia and is partially caused by over-fertilisation, clear-felling and grazing. Both contaminants pose problems to ecosystem health and raise human health concerns for both present and future generations. It has been noted that it is far better to prevent groundwater pollution than to spend considerable resources to clean up polluted aquifers. Despite this, there is no groundwater management plan established for Macksville, which is situated in the Nambucca Shire, and which classified as in medium-risk of groundwater pollution.

In general, nutrient surpluses on organic farms are lower than conventional agriculture and thus the pollution of ground and surface water and air is less. In particular, nitrate leaching has been shown to be generally less from organic than from conventional farming methods. This is due to numerous reasons, including lower stocking rates, absence of synthetic nitrogen fertilisers, crop rotations and fallowing. Some nitrogen leaching can however occur in grazed fields, where leys are ploughed and there is a lack of synchronicity between the release of nitrogen and crop uptake. Human deaths related to pesticide poisoning are also avoided in organic/biodynamic agriculture as are potential adverse effects associated with long-term exposure to agricultural chemicals. Accordingly, the National Standard's prohibition on synthetic fertilisers and herbicides is further consistent with the ESD in agriculture guideline of preventing adverse on-site and off-site impacts on the environment and other sectors of the community.

With regards to phosphorus leaching from organic/biodynamic farms, studies abroad have noted a decline in phosphorus leaching following conversion. However, the sustainability of organic broad acre farming in Australia has been questioned. It has been suggested that practices required under the 2000 certification standards were insufficient to meet phosphorus requirements of broad acre farming over the long term. However, the study assumes that phosphorous is a finite resource present only in the top centimetres of soil. Studies both overseas and in Tasmania are finding soil biology makes phosphorus available from subsoil rocks, creating a potentially endless renewable resource. Moreover, low phosphorus levels on organic farms can be supplemented by the addition of rock phosphate and/or compost.

Phosphorus leaching and subsequent pollution of waterways has been of concern in the Nambucca Shire. For the three years prior to 2007, all seven surface water sites in the Shire tested for phosphorus and nitrate leaching exceeded phosphorous water quality guidelines in at least one of those years by between 8.3% - 58.3%, with five water sites surpassing guidelines in all but one of those years. However, tests for 2006 – 2007 showed only site 16, situated 3.5 km up Newee Creek from confluence with Nambucca River, exceeded guidelines by 9% and was the only testing point that exceeded guidelines in all years studied. Given that organic/biodynamic agriculture has been found to limit runoff, there exists potential for organic/biodynamic agriculture within the Nambucca Shire to reduce phosphorus leaching and to help alleviate this adverse environmental impact and move the Shire towards the identified goals of ESD in agriculture.

5.1.3. Enhancement of Biodiversity

In general, biodiversity is more abundant on organic/biodynamic farms then conventionally managed farms and thus in line with the ESD in agriculture goal of protecting and maintaining biodiversity. However, studies on the impact of organic agriculture on biodiversity in Australia are rare, with scientific studies on this area mainly originating from Europe and North America. Studies from those continents illustrate greater genetic, floral, faunal, and habit diversity in organic systems compared to conventional agriculture, both in absolute and relative terms. This is not surprising given that maintaining and enhancing biodiversity is a primary concern of organic/biodynamic farmers as increased biodiversity boosts valuable ecological services including pollination, pest control, and soil fertility. This value of organic/biodynamic agriculture is consistent with the ESD in agriculture of protecting and restoring the natural resource base upon which agriculture depends. With regards to that principle, specific organic/biodynamic management practices that maintain or enhance biodiversity and which are thus consistent with protecting and restoring the natural resource base, are the prohibition on synthetic fertilisers and herbicides, sympathetic management of non-cropped habitats and preservation of mixed farming.

The absence of synthetic pesticides is one feature of organic agriculture that is beneficial to both flora and fauna. While species diversity is connected to local site conditions, organic farming promotes numerous and highly varied flora in regions with a high potential for biodiversity. Species diversity has been found to be up to 6 times higher on organic farms and native endangered flora diversity more pronounced on organic farms. One study has found a 50 – 80% higher presence of one or more endangered species on organic farms compared to 15 – 30% on conventional. Weed populations tend to be higher and more diverse with rarer or declining species tending to favour organic farms. By ensuring greater diversity of flora, food sources for birds, mammals and insects, beneficial or otherwise, are enhanced.

Fauna is also more diverse on organic farms. Studies in Europe have shown more abundant and diverse earthworms, soil and surface living arthropods, while studies in New Zealand have shown significantly higher levels of some beneficial insects and more diverse predatory and parasitic communities. Avian species also favour organic conditions, with annual increases in bird populations being noted following conversion to organic. Studies comparing mammalian diversity are few, with only two being noted. In those studies, improved water quality and food availability increased small mammal activity.

Further, ACO and NASAA Standards require only open-pollinated, non-hybrid seeds and seedlings to be used. Along with the tendency for organic agriculture in general to use rare and traditional non-hybrid seeds, such requirements contribute to conservation, restoration and maintenance of agricultural genetic diversity. Thus, organic agriculture has been recognised as an important tool to *in situ* conservation, restoration and maintenance of agricultural biodiversity. Again, this satisfies the principle of ESD in agriculture to protect and restore the natural resource base. In contrast, both conventional agriculture and GEOs have been recognised either as directly contributing to or having the potential to erode such genetic diversity.

Organic production further seeks to enhance native biodiversity via retaining or reforesting native vegetation, managing rangelands, waterways, floodplains, rivers, streams and wetlands and through the windbreaks and non-cultivated buffer zones. As noted in the Nambucca Shire *State of the Environment Report* 2006/2007, revegetation should endeavour to use species local to this biogeographical region as introduction of even native Australian species can result in pollution of the local gene pool. Native reforestation in Australia, management of rangelands, waterways, floodplains, rivers, streams and wetlands and non-cultivated buffer zones has been shown to increase the amount of native flora and fauna: to this end, there are specific Council initiatives undertaken in the Nambucca Shire to rehabilitate urban and coastal sites. There remains a need to specifically identify the degree to which organic agriculture positively contributes to native biodiversity in the Australian and indeed, the MNC and the Nambucca Shire context.

5.2. ESD of Organic Agriculture: Social **and Ethical** Considerations

5.2.1. Holism and the Land Community

From its beginnings 10 000 years ago, agriculture relied on biological and ecological systems to produce food and fibre until modern industrial agriculture began after World War II. In the 1920s the work of Sir Albert Howard (1873-1947) and Rudolf Steiner (1861-1925) led to the modern organic and biodynamic agricultural movement. While these agricultural systems differ somewhat in both theory and practice, both aim to imitate the workings of the biotic community through working *with* biological and ecological systems, rather than trying to force them to conform to some predetermined stereotype. The many mistakes made by pioneer immigrant agriculturalists during the colonial period in areas such as North America, Australia and New Zealand show the folly of trying to impose European agricultural regimes on areas with very different soil types, rainfall and so on. Interestingly, Howard was originally sent to India as an agricultural adviser, with the task of teaching Indians British farming methods, but he soon discovered that the local people were perfectly capable of farming successfully using methods that had been proven over thousands of years. In fact he learned a great deal from studying local agricultural, in particular the strong connection between healthy soil and healthy crops, livestock and people. He began the introduction to his hugely influential work *An Agricultural Testament* "[t]he maintenance of the fertility of the soil is the first condition of any permanent system of agriculture" and later states,

> Soil fertility is the condition which results from the operation of Nature's round, from the orderly revolution of the wheel of life, from the adoption and faithful execution of the first principle of agriculture -- there must always be a perfect balance between the processes of growth and the processes of decay. The consequences of this condition are a living soil, abundant crops of good quality, and live stock which possess the bloom of health.

The pioneer applied ecologist Aldo Leopold (1887-1948) worked tirelessly to encourage this type of approach. While Leopold was essentially a practical land manager, he also sought to develop what he termed the Land Ethic, which has become central to modern environmental ethics. He argued that conventional ethics deals only with relations between individuals and between individuals and society, and that "[t]here is as yet no ethic dealing with man's relation to the land and to the animals and plants which grow upon it." In conventional Western thought, land has been perceived and treated as a mere commodity to be exploited for short-term gain. And often the *only* gains have been short-term, as the dustbowls of the 1930s attest - indeed, he also refers to parts of Australia, where "a violent and accelerating wastage is in progress." Leopold thought that short-term exploitation will continue to be the norm until humans cease to see themselves as conquerors of nature. Instead, we should recognize that we are a part of natural systems, as acknowledged in the inclusive definition of "environment" quoted earlier. In a famous passage, he stated: "All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts … The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land." "In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also for the community as such."

Rooted in holistic thought, organic/biodynamic farming reflects the realisation that the whole system cannot be understood simply through understanding its parts. Howard summed up the holistic approach to agriculture as follows:

> The nature of soil fertility can only be understood if it is considered in relation to Nature's round. In this study we must at the outset emancipate ourselves from the conventional approach to agricultural problems by means of the separate sciences and above all from the statistical consideration of the evidence afforded by the ordinary field experiment. Instead of breaking up the subject into fragments and studying agriculture in piecemeal fashion by the analytical methods of science, appropriate only to the discovery of new facts, we must adopt a synthetic approach and look at the wheel of life as one great subject and not as if it were a patchwork of unrelated things.

Accordingly, holism recognises that we cannot simply reduce foodstuffs, for example, to individual components such as vitamins, starches and proteins. Like ecosystems, foods are more than a collection of these things: the whole is greater than the sum of its parts. There is nothing mysterious or novel about holistic thinking, which is essential to such activities as making a car, a movie or a cake – a thorough knowledge of the properties of flour, eggs, butter, water and baking powder will not tell you how to bake a sponge, nor what it will taste like. Similarly, every sports enthusiast knows that a group of highly talented individuals do not necessarily combine into a great team, while some very successful teams have lacked individually brilliant stars.

Consequently, sound agricultural practice cannot be reduced, for example, to increasing yields and controlling weeds and pests but rather requires an integrated approach that takes into account that a simple change in one area can affect the whole system. So, the decision to introduce cane toads to control the cane beetle was approached solely from the perspective of pest control, but had widespread impacts on the stability of the whole system.

From this perspective, things do not exist in isolation: it is not until we understand the role of say, soil biota in the functioning of the whole ecosystem that we can fully understand the individual: agricultural species become more akin to the function of an organism than the function of a machine. One obvious difference is while a machine is also more than the sum of its parts, nonetheless defective parts can be simply replaced. Another is that a machine can function without interacting with its environment, for instance a space satellite. Each individual species is inherently interconnected and interdependent and is indeed determined by interactions with the wider environment. Accordingly, agricultural systems, species and practices are context-dependent: what is sustainable in the Nambucca Shire may not be sustainable in central Australia. Species become endemic; they change, dependent on the context in which they evolve and the climatic nature of their surroundings. Relationships, species and individuals form with other members of their immediate biotic community - prey and predator, for example, mutually help adaptation and coevolve to reach their genetic potential. To promote such relationships, organic and biodynamic farming recognise the mutually beneficial relationship that arises from integrating undeveloped and agricultural systems in one area. Thus, organic/biodynamic agriculture can be seen as a type of agriculture that aims to maintain stability, promote adaptility and enhance genetic and ecosystem diversity.

5.2.2. Motivations: Producers

The original concerns that led to the development of organic agriculture are currently the primary motivating factors both in the conversion to organic/biodynamic production and in the consumption of organic/biodynamic products in Australia. Concern for the environment (27%) and health concerns (21%) are by far the most influential factors in the decision to adopt or convert to organic/biodynamic practices. Conversion to and adoption of organic/biodynamic production is also motivated by other factors, namely property viability (19%), lifestyle reasons (13%), decrease in input prices (8%), conventional farm system not working (5%), other (5%) and potential price premiums (3%). More recent Australian industry analysis shows further socio-demographic considerations that influence conversion to or adoption of organic/biodynamic farming including educational level, age (>50 years – slightly higher at around 54 years in Nambucca) and that organic/biodynamic farming supports a high number of female property managers and people with no history of family farming.

5.2.3. Motivations: Consumers

Consumers of organic/biodynamic products are similarly motivated:

- Health and safety – recent food safety scares including BSE have raised consumer concerns about health issues and risks associated with chemical residues, preservatives and additives, animal growth hormones and antibiotics, biological contaminants and created unease about irradiation and GEOs. This has led some consumers to value what they perceive as more natural content in food lacking these features. Whether or not these concerns are justified, they are real, and organic foods are widely perceived as healthier. The desire for natural content, in this sense, is the most dominant motivational factor in the purchase of organic goods.

- Environment – the belief that organic production (including fibres such as cotton, wool and hemp) is more environmentally sustainable than conventional agriculture provides a motivation for paying price premiums for environmental values (though this has potentially undesirable social outcomes, discussed below).

- Taste, sensory and emotional appeal – organic foods are often perceived to taste and smell better than conventionally produced goods and can evoke feelings of safety and tradition. Appeal is the third most motivating factor in the consumption of organic foods.

- Social and cultural – for some people, organic farming is seen as a potential remedy for rural social decline and low employment rates and can be a response to the globalisation of the world food chain. The "slow food" movement, founded by the Italian writer and anti fast food activist Carlo Petrini, has strong connections to the organics movement by virtue of its emphasis on cooking and eating within one's own ecoregion. It focuses particularly on food as a cultural product as well as on health and environmental issues. Slow Food International currently has 83 000 members around the world. The management of organic farms is also noted to have a high rate of women in comparison to conventional farming.

5.2.4. Equity Issues

In Australia, retail prices for organic/biodynamic goods are, on average, 80% higher than that of their conventional counterparts. In NSW, retail prices for organic/biodynamic goods tend to be 56% higher than conventionally produced foodstuffs, which is lower than that of other States. These premiums are well in excess of what most consumers are willing to pay - surveys carried out in America indicate that price premiums should be no more than 10%. In regional communities such as the Nambucca Shire which have a low socio-economic status, consumers are even more unlikely to pay such high premiums, especially for staple foods, such as organic/biodynamic milk and vegetables. In countries such as Austria, Denmark, Sweden and Switzerland where price premiums are lower, turnover of organic/biodynamic produce has increased considerably. Consequently, unless price-premiums are within a range that is acceptable to a wide range of consumers, such a difference in retail cost is likely to potentially limit the demand to dedicated organic consumers of the middle or higher income brackets. Lower retail price-premiums will also ensure that accessibility to food of high nutritional quality remains within the reach of lower income earners. Otherwise, there is a disparity between the NSW Department of Agriculture Guidelines for ESD in agriculture stating that it is sustainable if it (i) responds to consumer needs for food and fibre products that are healthy and of high quality and (ii) takes full account of the costs of production, including environmental costs, and ensures its pricing reflects these costs, and the reality of restricted access to organic/biodynamic produce.

5.2.5. Organic/biodynamic Labelling Considerations.

Through providing minimum production requirements for products labelled organic and biodynamic, the National Standard ensures transparency and credibility and protects consumers against deception and fraud. But while legally binding at the export level, it is considered private and not capable of enforcement at the national level. Without a recognised Australian Standard to ensure quality and integrity of produce marketed as organic or biodynamic, the National Standard was adopted as a de facto standard governing organic produce sold in Australia. The development of an Australian Standard for Organic and Biodynamic Produce is currently in progress and seeks to overcome the gaps in the current regime, for example by regulating imported organic products and ensuring all goods that are claimed to have 'organic' status comply with clearly defined criteria. The latter point was raised in a recent Federal Court judgement, where the need for a precise definition of 'organic' was noted. In the interim, it is suggested that the National Standard operates as the Australian Standard.

As discussed below, numerous different terms can be applied to organic/biodynamic produce and interpreting the various labels can, from a consumer's perspective, be confusing and requires an existing level of knowledge. However, transparent, accurate and consistent labelling and logos are vital to the organic industry. Such labelling informs consumers that products are organic or biodynamic and can include the ways in which they differ from conventionally produced goods. Widely recognised logos also increase consumer confidence that their purchase is certified organic. However, as we have noted, in Australia, there is neither a requirement to label Australian or imported organic/biodynamic produce or a single Australian label to differentiate organic/biodynamic products from their conventional counterparts. Currently the certification organisations all use different logos and may, in addition, use the AQIS national regulatory mark. In addition, consumers may also have to interpret foreign logos to determine the organic status of produce. Accordingly, there have been numerous calls that a nationally recognised logo is crucial if the industry is to expand even further.

5.3. ESD of Organic Agriculture: Economic Considerations

The development of the organic/biodynamic industry has the potential to contribute positively to a viable economy while contributing positively to the environment and society. Given the considerable expansion of the organic/biodynamic market, both within Australia and abroad, the lack of an up-to-date substantial and comparative economic analysis is needed in order to give a current picture. Comparative market analysis of different sectors of the Australian organic/biodynamic industry is hard to find, with few comparative reports available. The documents discussed below focus on broad acre grain production and the on-farm costs and returns from biodynamic milk production. Due to this narrow and specific focus and the age of the studies referred to, caution must be exercised – the studies referred to cannot be taken as indicative of the *current* economic viability of the organic industry as in part or in whole. Moreover, while similar in their conclusions, the application of foreign data to the unique Australian context must be treated cautiously.

5.3.1. Development Potential for Organic/biodynamic Produce

While production of organic/biodynamic foodstuffs is increasing in Australia, consumption is increasing at a greater rate - between 25 – 40% per annum - resulting in insufficient supply to meet demand at both the national and international level. Australia already exports the majority of its organic/biodynamic goods to areas such as Asia, Europe and North America and has "… has great potential to enhance its existing reputation as a supplier of 'clean' and 'green' agricultural products and capture a share of the expanding organic and clean markets." In particular, organic/biodynamic beef, carrots, citrus, wheat and wine are priorities to develop. A considerable number of other organic/biodynamic produce have likely export potential: apples, asparagus, bananas, canola, dairy products, honey, oats, rice, soybean, safflower, sugar and onions. Organic/biodynamic broccoli, eggs, fish, grapes, herbs, nectarines, pears, plums, poultry, potatoes and sunflower are considered to have possible export potential. There is also considerable opportunity to export grains around the world.

Like markets abroad, Australian suppliers are also noting a shortfall in organic dairy products - the Organic Dairy Farmers Cooperative, recently issued calls for more organic milk producers. Organic/biodynamic horticulture, meat and other products including fish and wine also have development potential at the national level. A number of horticultural products are particularly suited to be grown in NSW, namely, beef, milk products, flour, oats, rice and horticultural products including apples, avocados, bananas, citrus (especially oranges), macadamia nuts, mangoes, broccoli, carrots, potatoes, and tomatoes.

Shortfalls in national supply of organic/biodynamic foodstuffs have lead to importation of approximately $13 million worth of organic/biodynamic produce into Australia. Largely, processed goods, including coffee, pasta sauces, olive oil, soy drinks, cotton, and personal care items are imported from the United Kingdom and the United States and some fresh produce including kiwifruit from New Zealand. While the importation of processed goods is largely necessary due to the relatively low amount of organic/biodynamic processing that occurs in Australia, other goods such as organic herbs and spices, coffee and teas, vegetables are imported to meet shortfalls in domestic supply.

A diverse range of organic/biodynamic products are in demand at local, national and international levels. Thus, suitable development of the organic/biodynamic industry could allow for diversity and flexibility within economic systems and for different commodities to be produced in various locations, thereby accommodating regional differences. However, as consumer perceptions of the environmental sustainability and human health and safety benefits of organic/biodynamic agricultural products are responsible for the rise in demand of such products, any expansion of organic/biodynamic agriculture in a locality is sensibly coupled with consumer education.

5.3.2. Inputs in Organic/biodynamic Agriculture

The principles of ESD in agriculture require financial viability, both now and into the future. During the years 1998 – 2000, variable input costs on organic/biodynamic broad acre farms were on average substantially less than on conventional broad acre farming. Organic/biodynamic farmers spent less on pesticides and nutrients per hectare than conventional farmers, resulting in an overall benefit to the economic wellbeing of farmers, and society and the environment in general.

Some financial characteristics of organic and conventional farms ($/ha operated).

Source: RIRDC

The situation was similar in the production of biodynamic milk during 1989 - 1992. Conventional farmers spent slightly more on fertilisers, agistment, feed concentrates, irrigation and drainage, cropping and weed and pest control than their biodynamic counterparts. Foreign studies of organic production costs compared to conventional methods in the EU and the USA confirmed this trend, with costs declining by around 10% and 26% respectively. Fixed costs such as power, repairs, depreciation of machinery, property charges and depreciation and capital costs also tend to be similar or lower on Australian organic/biodynamic farms.

Organic/biodynamic farmers surveyed in broad acre production had lower hired labour costs but higher family labour input than their conventional neighbours. Another report has noted that that 75% of respondents did not report extra labour costs during the conversion process. Similarly, labour costs on Australian biodynamic dairy farms have been found to be similar or lower than those of conventional dairy farms.

Higher labour costs are not necessarily negative - the Food and Agriculture Organisation of the United Nations has noted that higher labour requirements may actually alleviate unemployment in rural communities and create a stabilised employment base. Should this occur, certain types of organic/biodynamic agriculture would take steps towards the ESD in agriculture goal of contributing positively to society in a manner that accommodates regional differences.

5.3.3. Output of Organic/biodynamic Producers

Output in terms of productivity differs between conventional and organic/biodynamic milk production in Australia and in many, but not all instances favour conventional methods. Reductions in yield are however influenced by the intensity and extensiveness of the farming method employed and this factor must be taken into consideration when reviewing or undertaking economic analyses.

For the years studied, milk production on biodynamic farms per cow and hectare was 70 – 80% that of conventional dairy farms and the cost of producing a litre of milk was 3 – 15% higher. This however was influenced by a lower percentage of Friesian cattle being raised on biodynamic farms. The situation is similar in Switzerland, Austria, Germany and Denmark, where the yield from organic dairy farms is around 9 – 30% less that of conventional dairy.

Yield from broad acre wheat production differs between conventional and organic in some instances. An Australian report notes that for the years studied, organic farms produced between 33 – 50% less than conventional a figure substantiated in research on cereal crops in Britain and Europe which shows a decline of around 60 – 70%. The Australian report notes that this disparity could be caused by a tendency for newly converted farms to have a lower yield than farms certified for a longer time period. With some crops, newly converted farms tend to experience a decline in yield as biological and nutrient systems re-establish, synthetic chemicals are phased out and farmers convert to new management techniques.

For example, The Rodale Institute's *Farming Systems Trial* showed that on average corn yields declined by 29% for the first 5 years following conversion to organic but had comparable yields following that time. Indeed, corn production was higher than on conventional farms in drought conditions due to the soil's ability to retain and absorb moisture. A decline in yield was not evident in comparisons between organic and conventionally produced soy bean with organic soy bean producing more than conventional soy in the initial years of the trial. Subsequent years showed a similar yield between systems.

Lower yields from organic/biodynamic production can be problematic where productivity increases are relied on to maintain or increase competitiveness in both the national and international markets. Given that the export of conventional agricultural commodities has relied on increased yields for the past 30 years to offset 2.4% decline in agricultural profitability, decline in yield is often seen as a negative consequence of conversion to organic/biodynamic. However, a holistic viewpoint takes into account matters such as a reduction in adverse environmental impacts from adoption or conversion to organic/biodynamic agriculture, and does not view either an increase or decrease in yield in a vacuum – a point discussed in detail in the following section.

5.3.4. Price Premiums of Organic/biodynamic Produce

Studies note that premiums for organic/biodynamic goods are crucial to the financial viability of an organic/biodynamic farm and help offset any losses caused by a decrease in yield, and to offset higher inputs of fuel and labour, where this is required. In Australia during 1998 – 2000, farmers received a 60% price premium for organic/biodynamic broad acre grains and more recently, as much as 200% for wholesale wheat in Germany and the UK. Premiums for organic/biodynamic milk are also higher than conventional milk. In Australia during 2004, organic/biodynamic milk was estimated to have a farm gate value of $0.53 compared to $0.279 and $0.315 per litre for conventional milk for 2003-2004 and 2004-2005, respectively. Organic/biodynamic milk prices in Europe are 15 – 25% higher than conventional dairy.

More recent analysis has been undertaken to estimate the *average* farm gate price for a variety of other Australian organic/biodynamic goods:

- Beef: $321.11 per head;
- Sheep: $32.41 per head;
- Poultry: $2.76 per bird;
- Eggs: $2.20 per dozen.

Organic/biodynamic cattle sell for well above the reserve price in online auctions. In October 2007, a Queensland central coast farmer received $1.76, $1.68 and 1.66 l/w kg for 298 certified organic steers, amounting to $19, 800 above the reserve price. In contrast, conventionally farmed medium steers sold through saleyards that month received $1.53 l/w kg. National indicators for the sale of conventionally farmed mutton showed an average price of $27.20 per head for October 2007. The national value of conventionally farmed poultry is difficult to determine due to the structure of the chicken industry. Conventional chicken farmers are paid for the upkeep of the chickens as opposed to the chickens themselves.

Whether or not reduced inputs and higher premiums are sufficient to make conventional and organic/biodynamic farming financially comparable is dependent on the type of industry reviewed and is likely to be variable across industries. Comparisons on returns from both broad acre and dairy farms in Australia for the years studied illustrate that the total returns for organic/biodynamic broad acre farms is 50 – 75% that of conventional farms while biodynamic dairy farms receive 60% of the cash receipt of conventional farms. Total cash costs on organic broad acre farms were 60% of conventional and biodynamic dairy farms were between 33 – 44% lower than that of conventional farms. Thus while organic/biodynamic farmers often receive a price premium for the goods, farm cash operating surpluses are lower in both the production of broad acre grain and biodynamic dairy. For the years studied, the farm surplus was variable in the production of grain but in favour of conventional farming and 42 – 50% (milk) lower on organic/biodynamic farms than on conventional farms. More recent comparisons of organic/biodynamic and conventional dairy farms worldwide indicate that nearly all organic/biodynamic farms studied in Europe have a significantly higher share of direct payments in the farm income.

However, given the differences in price premiums between the earlier analyses and the more recent figures above, there is the potential for the discrepancy between conventional and organic/biodynamic production to have narrowed. This is especially due to the observation that if the studied biodynamic dairy farms had at the time received a premium increase of around $0.10 litre then biodynamic farms would have been as profitable as their conventional counterparts. Moreover, a 2004 survey of farmers who had converted or adopted organic/biodynamic production indicates that those disparities may in fact have narrowed. That survey showed that farmers who had converted to organic/biodynamic production agreed/strongly agreed that the economic rewards of being a certified organic/biodynamic producer outweighed the costs (57%), 54% disagreed/strongly disagreed that input costs for farming were higher than conventional farming and 43% disagreed/strongly disagreed that marketing costs were higher for organic/biodynamic produce. When compared to conventional farming, farmers who began as organic/biodynamic agreed/strongly agreed that the financial rewards were greater (52%), and disagreed/strongly disagreed that the input and marketing costs were higher (42% and 41%).

Moreover, it is important to note that the Australian economic analyses focus on on-farm costs and benefits and do not take into account off-farm costs and effects (including water quality, biodiversity, and pollution), biological efficiency or impacts on the community at large through effects on human health and safety. Indeed,

> only when those off-farm costs have been included can a conclusion be derived about the economic benefits of [biodynamic and organic] farming for the nation as a whole, rather than for the farmer.

If conventional agricultural was required to pay for the pollution of common property and/or the cost of fertiliser and pesticides were increased to take account of environmental costs, as required by the principles of ESD in agriculture, then it is likely that the difference between farm-gate incomes between the systems would reduce and/or organic systems would become more financially viable than their conventional counterparts. However, the economic cost of environmental degradation and the actual economic value of environmental services are hard to quantify and most environmental services are underpriced or unrecognised. Nonetheless, some attempts have been made to estimate the value of ecosystem services and can begin to provide an indication of the considerable costs that result from unsustainable agricultural management.

The economic value of services provided by ecological systems for the entire biosphere has been estimated to be worth at least US$16 – 54 trillion per year, with an estimated average of US$33 trillion. To put this in perspective, at the time this estimate was published in 1997, the estimated average was 1.8 times higher than the global GNP. Australian native flora and fauna provide considerable ecosystem services and are crucial to the continued viability of agriculture – the value of crop pollination alone is estimated to be worth $1.2 billion per annum in Australia.

Environmental degradation and resultant loss of agricultural production is currently costed at approximately $1.2 billion or 5% of the total value of agricultural production. More specifically, the combined approximate costs to Australian agriculture from the loss of production as a result of saline, sodic and acidic soils were $2.6 million in 2000. Effects to irrigation and livestock from algae bloom, which is in part caused by fertiliser runoff, are substantial – the cost to irrigators alone is approximately $15 million per annum and to other farmers around $30 million per year. Losses to recreation and aesthetic value cost $96 million per year.

Repair bills are also sizable – the cost of repairing natural systems in general is estimated to be $2 – 6 billion per annum. More specifically, repair of salinity and water logging resulting from clearing of vegetation is estimated to be between $20 – 65 billion over 10 years. Most of the funding to repair ecosystem services comes from taxes – Australia invested $1.5 billion per annum in biodiversity and natural systems, $1.2 billion of which was government funded. Introduced species incur extra cost through eradication schemes, for example, if left unchecked, the fire ant is estimated to cost rural industry $6.7 billion over the next 30 years.

Clearly, it is cheaper to avoid such costs and reasonable to require degraders of environmental systems to pay their share of costs arising from the degradation of natural systems. The FAO has taken this a step further and suggested the introduction of incentives to reflect the social, environmental and economic benefits provided by environmental services. Suggestions include a ‘Payment for Environmental Services’ programme, information provision, policy reforms, command-and-control regulations and taxation – all of which are highly relevant to agricultural producers.

The ability of organic/biodynamic agriculture to avoid, and in some cases, remediate, these environmental costs is consistent with numerous principles of ESD in agriculture, including the ability to take the full costs of production into account, protecting and restoring the natural resource base, and prevention of adverse on-site and off-site environmental and social impacts. Accordingly, while the overall farm gate value of organic/biodynamic products tends to be less than conventional varieties, especially in the conversion process, organic/biodynamic agriculture places less financial burden on society.

Part 6

6.0 Genetic Engineering in Agriculture or an Organic/biodynamic Nambucca Shire?

The Nambucca Shire is situated 510 km north of Sydney and 490 km south of Brisbane. Covering 1, 490 square kilometers it has a varied topography including beaches, steep hill slopes (60%), valleys, flood plains (20%) and adjacent undulating lands (20%). As of 2006, the Shire's population was 18,525, with the majority of the population found at Nambucca Heads, Macksville, Bowraville, Valla Beach, and Scotts Head.

Over the last 20 years, there has been a decline in the amount of land used for primary production in the Nambucca Shire. However, agriculture continues to play a significant role in social and economic viability of the Nambucca Shire and its environment. Around 55% of land in the region is zoned rural and as of 2001, there were a total of 334 agricultural establishments covering 34,541 ha in the Shire. It is the third biggest industry in the region, next to retail, health and community services. Together with fishing and forestry, agriculture accounted for 10.3% of employment in the Nambucca Shire during 1996 – 2001.

Beef, timber, macadamias, dairy, organics, vegetables/fruit and niche products contribute $18.8 million to the local economy. A significant portion of this arises from livestock products. Including slaughtering and other disposals, in 2001, these products held a total economic value for the Shire of $10 million. The macadamia industry is also significant and grosses around $6 million per annum and is expected to increase production by a third over the next three years.

Over the past five years, the type of agricultural product produced in the Shire has changed, and local agricultural diversification is being promoted to address the downturn in the rural sector, to increase incomes and improve the lifestyle of rural people. The Mid North Coast Regional Development Board is currently working in conjunction with the Nambucca Shire's Economic Development Officer and local organic and conventional farmers to promote the development of more sustainable farming practices in the region. This is partly responsible for recent changes to agricultural enterprises in the area – over recent years, the number of dairy and vegetable farmers has decreased and beef and timber remain static. Macadamia farming and organic/biodynamic agriculture have increased as have niche products such as rabbits and organic garlic.[6]

Approximately 25 holdings in the Nambucca Shire are certified organic or biodynamic. Equating to 7.5% of the Shire's agriculture, the proportion of certified producers is significantly greater than that the estimated figure for Australia as a whole, where it accounts for around 1.7% of total agricultural production.

Local macadamia farmers are also adopting more sustainable farming practices. Most macadamia farmers in the area use integrated pest management strategies, which include the introduction of wasps as biological pest control agents. Use of chemical sprays is limited to necessity, with preference given to organic sprays where these are available. Although not certified as organic or biodynamic, 10-15 local growers practice organic/biodynamic farming practices. It is expected that when effective organic controls become available the entire industry will cease spraying chemical insecticides.

The promotion of alternative and diversified agricultural practices in the Shire is in accordance with the Local Government Act (LGA) 1993 and the principles of ESD in agriculture. According to the NSW Shires Association, "… [l]ocal government … [has] an essential and legitimate role in managing the local environment …" and can take a leadership role in the development of industry. Thus while agricultural land use generally does not require development consent under the Shire's Local Environment Plan (LEP), in exercising a leadership role, Council legitimately promotes the development of sustainable agricultural systems in the Nambucca Shire. However, to meet its obligations under the LGA, it is arguable that Council must ensure that the type of agriculture it promotes properly manages, develops, protects, restores, enhances and conserves the local environment in a manner that is consistent with and promotes the principles of ESD.

In the case organic/biodynamic agriculture, this study has found that the principles of ESD in agriculture are satisfied to a greater level by organic/biodynamic farming than by the use of GE organisms in agriculture. This, in conjunction with the current focus of the Nambucca Shire Council to promote diversification of the region's agriculture and the significant amount of certified organic/biodynamic producers in the region, supports the proposition that, in the interests of sustainability, it is beneficial for the Nambucca Shire to further develop the region's organic/biodynamic farming industry.

Development of the local industry should take into account local, national and international demand for organic/biodynamic produce and the type of produce suited to the region. For example, the promotion of the region's organic/biodynamic beef and milk industry would be consistent with current land use in the Nambucca Shire and would work towards national and international demands for increased production of such produce.

In order to help ease the transition of local producers to certified organic/biodynamic production care needs to be taken to ensure that producers are aware of relevant support systems, such as those provided by the various certification authorities and the Mid North Coast Regional Development Board. Landcare, local environmental and seed-saving groups could also be of assistance.

At the retail level, sensible consumer education of the value of organic/biodynamic produce would further ease the transition of local producers to certified organic/biodynamic production. Ensuring that the retail value of locally produced organic/biodynamic produce is not significantly higher than that of conventionally produced goods, would further help secure the financial viability of the local industry.

As it is impossible to prevent cross-pollination of GEOs with un-engineered varieties and because all organic/biodynamic Standards prohibit the use of GEOs, it is advisable that the Nambucca Shire Council protects and promotes the development of the local organic/biodynamic industry through investigating and implementing a policy governing the release of GEOs in the Nambucca Shire. In absence of such a policy the long-term viability of the local organic/biodynamic industry cannot be ensured.

The Local Government and Shires Association of NSW commissioned a paper to guide local governments on the issue of GE crops. Recommendations include:

- Adopt the precautionary principle and to involve and inform the community through education and public participation;
- Establish communication links with other councils for information sharing on various options and strategies adopted by local councils. In the case of the Nambucca Shire, it is advisable that Council liaise with Coffs Harbour Council and Byron Shire Council, both of which have policies governing the release of GEOs in their localities;
- Undertake public consultation to establish the public's position on the GM crop issue;
- Establish a LEP consistent with public expectation and other relevant Regional Environment Plans and State Environmental Planning Policies;
- Establish a champion within the councils administrative structure to act as a focal point for all information and activities relating to the GM crop issue and to report on progress at the monthly council meetings;
- Establish a closer relationship with other local councils, State and Commonwealth government decision makers. In the event that a council decides to prohibit or strictly control GEOs, cooperation with peak environmental groups is recommended to help with public education.

Moreover, a policy on GEOs would enable the Nambucca Shire Council to appropriately respond to correspondence from the Gene Technology Regulator. These responses coupled with public education on organic/biodynamic agriculture and GEOs and would further benefit the development of the local industry. While public consultation is undertaken, and while any amendments to the local LEP are implemented, it is further advisable, in the interests of safeguarding the wellbeing and safety of both present and future generations, the environment and economy, that the Nambucca Shire Council adopts a precautionary approach to the release of GEOs into the local environment.

Appendix 1: Certified Organic Producers and Processors
150km radius of the Nambucca Shire

• **Name:** Ainsworth, John McDonald & Edna Joyce
Certifier and certification number: NASAA Cert **No. 2140**
Produce: Banana

Contact Details:
Address: Macksville, NSW
Phone: 02 6568 1502
Fax: 02 6568 1502

• **Name: Angarjon Anne, Garry & John Cooper/Davie**
Certifier and certification number: OGA Cert **No.** 1231 In Conversion to Organic
Produce: Russian Garlic

Contact Details:
Address: Nana Glen, NSW
Phone: (02) 6654 3720;
Mobile: 0429 015 489

• **Name: Atkins, Kevin**
Certifier and certification number: OGA Cert **No.** 1104
Produce: seasonal vegetables, mixed fruit

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 7467

• **Name: Avosam Pty Ltd Brockway, Chris**
Certifier and certification number: OGA Cert **No.** 543
Produce: avocado

Contact Details:
Address: Telegraph Point, NSW
Phone: 02 6585 0375;
Mobile: 0409 850 375

• **Name: Barbushco Bruce & Barbara Barlin**
Certifier and certification number: OGA Cert **No.** 951
Produce: Australian native spices - lemon, aniseed, cinnamon myrtle; lemon tea tree; Dorrigo pepper; riberries; Davidson plums

Contact Details:
Address: Lorne, NSW
Phone: 02 6556 9656
Email: barlinb@bigpond.com

• **Name: Bellinger Valley** (Messrs John Fleming)
Certifier and certification number: ACO Cert **No.** Producer 10275A
Produce: *Garlic*

Contact Details:
Address: Thora, NSW
Phone: 02 6655 8802
Email: bellingervalley@midcoast.com.au

• **Name: Bellbowra Terry Bates & Dawn Thornton**
Certifier and certification number: OGA Cert **No.** 1005
Produce: Russian Garlic, Mulch Hay (in small bales)

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 8747
Email: semgt@zip.com.au

• **Name:** Bowraville Tea Tree Farm
Certifier and certification number: NASAA Cert **No. 2570**
Produce: Garlic; Beef Cattle; Processing of certified organic tea tree

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 4141
Fax: 02 6564 4077
Email: theodorteatree@nor.com.au

• **Name: Corda, Jane & Glenn**
Certifier and certification number: OGA Cert **No.** 1090 In Conversion to Organic
Produce: Garlic

Contact Details:
Address: Bellingen, NSW
Phone: (02) 6655 0227; 0402 135 641

• **Name: Chodkiewicz, Carol**
Certifier and certification number: OGA Cert **No.** 744
Produce: Russian Garlic

Contact Details:

Address: Thora, NSW
Phone: (02) 6655 8555

• **Name: Clarence Compost Fergus Fysh**
Certifier and certification number: OGA Cert **No.** 776 Processor
Processing: bagged compost, potting mix.

Contact Details:
Address: Grafton, NSW
Phone: 02 6642 3857
Mobile: 0412 147 234

• **Name: CV & DH Barry**
Certifier and certification number: ACO Cert **No.** Producer BD10300IC
Produce: Herbs, Macadamia Nuts, Vegetables

Contact Details:
Address: Valla, NSW
Phone: 02 6569 5760
Email: barry_david@hotmail.com

• **Name: Coffs Organics** (Messrs Lynne Corrick)
Certifier and certification number: ACO Cert **No.** Producer 799A
Produce: Lemons; Limes; Lychees; Mandarins; Mixed Vegetables; Passionfruit; Wine Grapes

Contact Details:
Address: Bonville, NSW
Phone: 02 6653 5288;
Mobile: 0438 444 489
Email: les.lynne@netcall.com.au

Name: Forever Farm
Certifier and certification number: NASAA Cert **No. 2485**
Produce: Garlic; Mixed herbs

Contact Details:
Address: Bonville, NSW
Phone: 02 6653 4175
Fax: 02 6658 3279
Email: post2452@hot.net.au

• **Name: Forest Gate Organics** (Mr & Mrs John Neal)
Certifier and certification number: ACO Cert **No.** Producer 10515A
Produce: Chives, Fruit, Herbs, Mushrooms, Russian Garlic, Sprouts, Turmeric, Vegetables

Contact Details:
Address: Bellingen, NSW
Phone: 02 6655 1453
Email: john_neal2@bigpond.com

• **Name: Galinga Organics Nick Langham & Michelle Atkins**
Certifier and certification number: OGA Cert **No.** 1011
Produce: garlic - White Italian; pumpkin (seasonal); watermelon (seasonal)

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 7467

• **Name: Gill SS & GK**
Certifier and certification number: ACO Cert **No.** 2374A
Produce: Avocados, Bananas, Lemons

Contact Details:
Address: Boambee West, NSW
Phone: (02) 6658 5655

• **Name: Gino's Organic Garlic Jane & Glen Corda**
Certifier and certification number: OGA Cert **No.** 1090 In Conversion to Organic
Produce: Russian Garlic

Contact Details:
Address: Bellingen, NSW
Phone/fax: 02 6655 0227
Mobile: 0402 135 641 Glen; 0428 358 967 Jane
Email: gogarlic@bellnet.com.au

• **Name: Glenreagh Garlic Paul Levingston**
Certifier and certification number: OGA Cert **No.** 1132 In Conversion to Organic
Produce: giant Russian Garlic

Contact Details:
Address: Glenreagh, NSW
Phone: 02 6649 4494

• **Name: Glory Ridge Plantation Tony & Dianne Coe**
Certifier and certification number: OGA Cert **No.** 869
Produce: fresh bananas, dried bananas, carob coated bananas, avocado, mango, tomato, seasonal vegetables

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 7786
Mobile: 0408 402 173
Fax: 02 6564 8886

• **Name:** Golden Glen Bananas
Certifier and certification number: NASAA Cert **No. 2526**
Produce: Banana

Contact Details:
Address: Nambucca Heads, NSW
Phone: 02 6568 7392

• **Name: Gulliver Organics Pty Ltd Peter & Janelle Gulliver**
Certifier and certification number: OGA Cert **No.** 1169 In Conversion to Organic
Produce: Russian Garlic

Contact Details:
Address: Thora, NSW
Phone: 02 6655 8888
Mobile: 0428 504 600
Fax: 02 6655 8886
Email: organics@gulliver.com.au
Website: www.gulliver.com.au

• **Name: H & H Organics Paul Hoschke & Linda Hill**
Certifier and certification number: OGA Cert **No.** 624
Produce: bananas, citrus, annual mixed crops

Contact Details:
Address: Dairyville, NSW
Phone: 02 6653 8409 (home)

• **Name: Jocelynd Farms** (Mr Paul Dawson)
Certifier and certification number: ACO Pre-certification
Produce: Cattle, cereal, legumes

Contact Details:
Address: Nana Glen, NSW
Phone: 02 6654 3096
Mobile: 0402 576 261
Email: pvdawson@bigpond.com

• **Name: Jollity Farm Organics Heather & John Cairns**

Certifier and certification number: OGA Cert **No.** 1050 In Conversion to Organic
Produce: Russian garlic, limes, and vegetables

Contact Details:
Address: Repton, NSW
Phone: 02 6653 4291
Fax: 02 6653 4291
Email: heatherdarroch@hotmail.com

• **Name: Kia-Ora** (Mr Ekkehard Berner)
Certifier and certification number: ACO Cert **No.** Producer BD2165A
Produce: Cattle, Wine Grapes

Contact Details:
Address: Nana Glen NSW
Phone: (02) 6654 3561
Mobile: 0438 401 356
Email: Kia-Ora1@bigpond.com.au

• **Name: Leete, Paul & Lindy Johansen**
Certifier and certification number: OGA Cert **No.** 733
Produce: bananas, avocados - Lamb and Hass

Contact Details:
Address: Coffs Harbour, NSW
Phone: 02 6652 2663

• **Name: Lucas, Ben & Lisa Isles**
Certifier and certification number: OGA Cert **No.** 1256 In Conversion to Organic
Produce: Lady Finger bananas

Contact Details:
Address: Coffs Harbour, NSW
Mobile: 0438 258 622 (Lisa)

• **Name: McKillop, Steve**
Certifier and certification number: OGA Cert **No.** 882
Produce: coffee

Contact Details:
Address: Boambee, NSW
Phone: 02 6658 1999

• **Name: Momacs** (Mrs Jill Lee)
Certifier and certification number: ACO Cert **No.** Processor 10192P
Produce: Macadamia Nut Processing

Contact Details:
Address: South Kempsey NSW
Phone: 02 6563 1271
Mobile: 0407 458 241
Email: moinc@optusnet.com.au

• **Name: Moodie, Ross & Bev**
Certifier and certification number: OGA Cert **No.** 1049
Produce: Sweet Potato, Garlic, Zucchini, Rhubarb, Pumpkin

Contact Details:
Address: Upper Corindi, NSW
Phone: (02) 6649 2792
Mobile: 0407 895 530

• **Name: MT & RA Rowe**
Certifier and certification number: ACO Cert **No.** Producer 2453A
Produce: Cattle, Grain, Milk

Contact Details:
Address: Kempsey, NSW
Phone: (02) 6567 4293
Mobile: 0418 471 858
Email: m_r_rowe@tsn.cc

• **Name: Mulvihill, Chris**
Certifier and certification number: OGA Cert **No.** 811
Produce: garlic - Russian & Italian

Contact Details:
Address: Taylors Arm, NSW
Phone: 02 6564 2269

• **Name: Nana Glenn Organics Raymond & Tania Hughes**
Certifier and certification number: OGA Cert **No.** 1098 In Conversion to Organic
Produce: garlic - Russian

Contact Details:
Address: Glenreagh, NSW
Phone: 02 6649 2245

• **Name:** Norco Foods
Certifier and certification number: NASAA Cert **No.** Processor **2535P**
Produce: Milk (Pure Organic Lite Milk, Pure Organic Unhomogonised Whole Milk, Pure Organic Whole milk)

Contact Details:
Address: Raleigh, NSW
Phone: 02 6655 4288
Fax: 02 6655 4447
Email: neil.hudson@norco.com.au

• **Name: Norfolk Punch Australia Blair Montague-Drake**
Certifier and certification number: OGA Cert **No.** 429
Produce: bush tucker

Contact Details:
Address: Kendall, NSW
Phone: 02 6559 4464

• **Name: Orara River Organics Malcolm Rolstone & Nerida Howat**
Certifier and certification number: OGA Cert **No.** 856
Produce: Russian garlic, fruit, and vegetables

Contact Details:
Address: Glenreagh, NSW
Phone: 02 6569 5589

• **Name: Owen, Evan**
Certifier and certification number: OGA Cert **No.** 1096 In Conversion to Organic
Produce: lychees

Contact Details:
Address: Bowraville, NSW
Phone: 02 6564 7232

• **Name: Passion Paws Elizabeth Scott**
Certifier and certification number: OGA Cert **No.** 1014
Produce: oranges - navel, mandarins, and garlic - Russian

Contact Details:
Address: Bellingen, NSW
Email: escott3@bigpond.com.au

• **Name: Parker's Produce Alan Parker**
Certifier and certification number: OGA Cert **No.** 716
Produce: Rhubarb, Parsley, Carrots, Beetroot, Lettuce and Mixed Seasonal Crops

Contact Details:
Address: Rollands Plains, NSW
Phone: 02 6585 8203

• **Name:** Peter Wood Organics
Certifier and certification number: NASAA Cert **No. 2179**
Produce: Avocado; Mango; Mixed fruit; mixed vegetables

Contact Details:
Address: Coffs Harbour, NSW
Phone: 02 6651 3177
Fax: 02 6651 3177
Email: pjwoodii@hotmail.com

• **Name: Pipers Creek Grove David & Jules De Boer**
Certifier and certification number: OGA Cert **No.** 931
Produce: blood limes, Davidson Plum, Illawarra Plum, lemon & aniseed myrtle

Contact Details:
Address: Kempsey, NSW
Phone: 02 6562 4701
Email: jules@piperscreekgrove.com
Website: www.piperscreekgrove.com

• **Name: Pye, Mark & Elise**
Certifier and certification number: OGA Cert **No.** 1048 In Conversion to Organic
Produce: Russian garlic

Contact Details:
Address: Bellingen, NSW
Phone: 02 6655 9907

• **Name:** Robert and Anabel Emmett
Certifier and certification number: NASAA Cert **No. 2392**
Produce: Garlic

Contact Details:
Address: Bellingen, NSW
Phone: (02) 6655 1647

• **Name: Rose, Justin & Carolyn**
Certifier and certification number: OGA Cert **No.** 937
Produce: Russian garlic

Contact Details:
Address: Thora, NSW
Phone: 02 6655 8705

• **Name:** Rosewood River Organics

Certifier and certification number: NASAA Cert **No. 2360**
Produce: Garlic; Hay; Potatoes; Pumpkin; Beef Cattle

Contact Details:
Address: Thora, NSW
Phone: (02) 6655 8732
Email: roo@aapt.net.au

• **Name: Scallan, Rory & Sandy**
Certifier and certification number: OGA Cert **No.** 745
Produce: Russian garlic

Contact Details:
Address: Thora, NSW
Email: punka_s@hotmail.com

• **Name:** Sea Magic Organics
Certifier and certification number: NASAA Cert **No.** Input Manufacturer 2395M
Produce: Fertiliser (Fish Fertiliser); Importing and distribution of certified organic products; Seaweed Fertiliser

Contact Details:
Address: Coffs Harbour, NSW
Phone: 02 6652 3131
Fax: 02 6652 3132
Email: seamagic@swiftdsl.com.au

• **Name: Smith, Robin & Julie**
Certifier and certification number: OGA Cert **No.** 945
Produce: Bamboo, Garlic

Contact Details:
Address: Thora, NSW
Phone: (02) 6655 8724
Mobile: 0418 967 040

• **Name:** Soulfish
Certifier and certification number: NASAA Cert **No.** Processor **2455**
Produce: Silver Perch

Contact Details:
Address: Grafton, NSW
Phone: 02 6649 3549
Fax: 02 6649 3549
Email: timjones@organicfish.com.au

Website: www.organicfish.com.au

• **Name: The Tonaleah Community Kathy Taylor**
Certifier and certification number: OGA Cert **No.** 1081 In Conversion to Organic
Produce: garlic - Russian

Contact Details:
Address: Thora, NSW
Phone: 02 6655 8619

• **Name:** Timothy Jones & Ann Montgomery
Certifier and certification number: NASAA Cert **No.** Processor **2455SL1**
Processing: certified organic fish

Contact Details:
Address: Grafton, NSW
Phone: 02 6649 3549
Fax: 02 6649 3549
Email: timjones@organicfish.com.au

• **Name: Tomasoni Garlic Martin Tomasoni & Nikki Hancock**
Certifier and certification number: OGA Cert **No.** 1152 In Conversion to Organic
Produce: Russian garlic

Contact Details:
Address: Karangi, NSW
Phone: 02 6653 9003

• **Name: Tubman, Stephen**
Certifier and certification number: OGA Cert **No.** 1103 In Conversion to Organic
Produce: seasonal vegetables, seasonal fruit

Contact Details:
Address: Rolland Plains, NSW
Phone: 02 6585 8066

• **Name: Valerie Farm Pty Ltd** (Ms Bregje Aalders)
Certifier and certification number: ACO Cert **No.** Producer 2056BD & 2056A
Produce: Citrus Fruit, Fruit – Tropical, Garlic, Herbs, Vegetables

Contact Details:
Address: Thora, NSW
Phone: 02 6655 8641
Email: bregje@bigpond.com

• **Name: Valley Ag & Organics** (Mr Paul Joseph Foster)
Certifier and certification number: ACO Cert **No.** Producer 10286A
Produce: Garlic, Pumpkins

Contact Details:
Address: Bellingen, NSW
Phone: 02 6655 0231

• **Name: Wedding Bells Farm Alan Collopy**
Certifier and certification number: OGA Cert **No.** 1007
Produce: limes, lemons

Contact Details:
Address: Mullaway, NSW
Phone: 02 6654 2227

• **Name: Wenonah Headland Organic Farm** (Mr Peter Teece)
Certifier and certification number: ACO Cert **No.** Producer 2601BD
Produce: Garlic, Macadamia Nuts

Contact Details:
Address: Urunga, NSW
Phone: (02) 6655 3587
Email: whofarm@bigpond.com

• **Name: Yamstick Farm Wayne Brennan**
Certifier and certification number: OGA Cert **No.** 642
Produce: Eggs, Garlic

Contact Details:
Address: Missabotti, NSW
Email: yamstick@bigpond.com
Website: www.yamstick.com

• **Name: Yarrandang Jim O'Connell & Connie Seward**
Certifier and certification number: OGA Cert **No.** 968 In Conversion to Organic
Produce: Seeds, Herbs, Vegetables, Eggs - Free Range

Contact Details:
Address: Coffs Harbour, NSW
Phone: 02 6654 3173
Email: jimandconnieoconnell@yahoo.com.au

Appendix 2: Intentional Environmental Release of GEOs in Australia 2002 - 2007

Licence Date	Crop Type	Area (ha) max	Site location (State) Number of Sites (max)	Release Type	Project Status
2007	Cotton	26	NSW, QLD 13 sites	Limited and controlled	Current
2007	Cotton IR/HT	500	NSW, QLD 50 sites	Limited and controlled	Current
2007	Bread wheat Drought tolerant	0.315	VIC 2 sites	Limited and controlled	Current
2007	Sugarcane Altered plant architecture, enhanced water or improved nitrogen use efficiency	18	QLD: 9 sites	Limited and controlled	Current
2007	Canola HT/HB	252	NSW, SA, VIC 42 sites	Limited and controlled	Current
2006	Torenia MC	0.1	VIC 1 site	Limited and controlled	Current
2006	Cotton Waterlogging tolerant	0.3	NSW 1 site	Limited and controlled	Current
2006	Cotton IR/HT		All suitable cotton growing areas north of 22° south	Commercial release	Current
2006	Cotton IR	1.5	NSW 1 site	Limited and controlled	Current
2006	Cotton Water logging Efficiency	40	NSW 20 sites	Limited and controlled	Current
2006	Cotton Fungal Resistance	3	NSW, QLD 9 sites	Field Trial	Current
2006	Cotton IR/HT		All suitable	Commercial	Current

			cotton growing areas north of 22° south	release	
2006	Rose MC/ MG	0.1	VIC 1 site	Limited and controlled	Current
2006	Cotton HT		Current and potential cotton growing areas Australia wide. Transport and stockfeed anywhere in Australia	Commercial Release	Current
2006	Cotton IR/HT AR, RG		All suitable cotton growing areas south of latitude 22° south	Commercial release	Current
2005	Cotton IR, AR	1	NSW/QLD 2 sites	Limited and controlled	Surrendered
2006	Fowl adenovirus		VIC 5000 chickens in 3 PC1 containment facilities	Limited and controlled	Current
2005	Indian Mustard HT/HB	128	NSW, VIC, SA 17 sites	Field Trial	Current
2005	Cotton IR/HT/ AR/RG	1000	NSW, QLD 24 sites	Field Trial	Current
2005	Cotton IR/HT/ AR/RG	1811	NSW, QLD, WA, NT 91 sites	Field Trial	Current
2005	Bread Wheat Altered starch/AR	0.25	ACT 1 site	Field Trial	Current
2005	Bread Wheat Salt tolerance/HT	0.45	WA 1 site	Field Trial	Surrendered
2005	Rice HT/AR/	0.09	NSW 1 site	Field Trial	Current

	RG/GK				
2005	Sugarcane Altered production/AR	7.1	QLD 2 sites	Field Trial	Current
2005	Bovine Herpesvirus		QLD 180 animals in PC1 animal containment facility	Limited and controlled	Current
2004	Cotton RG/AR	0.2	NSW 1 site	Field Trial	Surrendered
2004	Cotton IR/AR	1.5	QLD 2 sites	Field Trial	Current
2004	White Clover VDR/AR	2	Victoria 1 site	Field Trial	Current
2004	Cotton I/HT	12.2	NSW, QLD, NT, WA 30 sites	Limited and controlled	Current
2004	Canola HT/HB	72	NSW, SA, VIC 12 sites	Field Trial	Current
2003	Cotton IR/HT	0.04	NSW 2 sites	Limited and controlled	Surrendered
2003	Cotton Modified fatty acid in oil	2	NSW 1 site	Field Trial	Current
2003	Cotton HT	45	NSW/QLD 16 sites	Field Trial	Surrendered
2003	Cotton IR/HT/AR	45	NSW 16 sites	Limited and controlled	Surrendered
2003	Cotton IR/HT/AR/RG	953.6	NSW, QLD, WA, NT 50 sites	Field Trial	Surrendered
2003	Cotton IR/AR	10	NSW 30 sites	Limited and controlled	Current
2003	Recombinant live oral cholera vaccine		Australia wide By prescription	Commercial release	Current
2003	Canola HT/HB	72	NSW, VIC, SA 12 sites	Field Trial	Current
2003	Grapevines MC/GFM/AR Modified sugar	0.38	VIC 1 site	Field Trial	Current

	composition, flower and fruiting				
2003	Carnation MC		Propagation, growth and distribution of GM plants and cut flowers Australia wide	Commercial release	Moved to GMO Register 27/3/07
2003	Pineapple RG/AR, reduction of blackheart, delayed flowering	0.22	QLD 2 sites	Field Trial	Current
2003	Pineapple HR/RG, delayed flowering	0.1	QLD 1 site	Field Trial	Current
2003	Papaya RG/AR, delayed ripening	1.07	QLD 1 site	Field Trial	Current
2003	Cotton I	3	WA 2 sites	Limited and controlled	Surrendered
2003	Cotton I/HT		All cotton growing areas in NSW/QLD South of latitude 22° South	Commercial release	Current
2003	Cotton I		Max 30% of all cotton growing areas in NSW/QLD South of latitude 22° South	Commercial release	Current
2003	Canola HT/HB		All canola growing regions in Australia	Commercial release*	Current
2003	Canola HT		All canola growing regions of Australia	General release*	Current
2002	Sugarcane GF RG	0.7	QLD 1 site	Limited and controlled	Surrendered

2002	Poppy Altered alkaloid	0.21	TAZ 1 site	Field Trial	Surrendered
2002	Cotton IR	3	NSW 3 sites	Field Trial	Current
2002	Cotton IR/HT	1.5	NSW 2 sites	Field Trial	Surrendered
2002	Cotton HT	2	NSW 1 site	Field Trial	Surrendered
2002	Cotton IR/HT		All cotton growing areas of Australia	Commercial release	Current/post harvest monitoring
2002	Canola HT	34	NSW, VIC, SA 26 sites	Field Trial	Surrendered
2002	Canola HT/HB	318	NSW, VIC, SA, WA 90 sites	Limited and controlled	Current
2002	Cotton IR	80	WA unspecified	Field Trial	Surrendered
2002	Cotton IR	500	WA 30 sites	Limited and controlled	Surrendered
2002	Poppy Altered alkaloid	0.2	WA 1 site	Limited and controlled	Surrendered
2002	Cotton IR/HT	10	NT, WA 10 sites	Limited and controlled	Surrendered
2002	Cotton IR/HT	480	QLD 6 sites	Limited and controlled	Surrendered
	Total ha 6439.125	Total Sites: > 1443			

Source: OGTR, ***List of applications and licences for Dealings involving Intentional Release (DIR) of GMOs into the environment*** **http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/ir-1**

Appendix 3: Approved GE foods Australia/ New Zealand	Labelled?	Genetically Engineered Organisms	Ingredient, Additives, and Processing Aids	Used in Following Foods	Public Submissions	Total	
					Support	**Oppose**	
A338 glyphosate-tolerant soybean line 40-3-2	**N**	**SOYBEAN**	Soybean flour soybean protein	Soy drinks, soy sauce, tofu processed meats/sausages/ salamis	15*	88	103
A481 glufosinate ammonium-tolerant soybean lines A2704-12 and A5547-127	**N** (DNA)		hydrolysed vegetable protein textured vegetable protein	bread dairy – drinks, yoghurts, desserts, ice cream	7	23	33 (3 N/O)
A387 glyphosate-tolerant soybean line G94-1, G94-19 and G168 -	**Y** special label to contain note on high oleic acid levels		soybean oil (UL) lecithin additive and flavour carriers/diluents tocopherols – vitamin E	baked goods – cakes, pies, pastries, biscuits soups and sauces cooking oils, salad dressings margarines and spreads, peanut butter confectionery, savoury snacks, infant food	4	40	44
A375 Glufosinate ammonium-tolerant corn line T25 **A362** Glyphosate-tolerant corn line GA21	**N** (DNA) **N** (DNA)	**CORN /MAIZE**	flour corn starch corn oil	bread dairy products – drinks, yoghurts, desserts baked goods – cakes, pies, pastries, biscuits	4 7	41 46	45 53

A362 Glyphosate-tolerant corn line NK603	**N**		corn protein and isolates	soft drinks and cordials corn syrups soups	7	46	53
A446 Insect protected and glufosinate-ammonium tolerant corn line 1507	**N** (DNA)		modified starches dextroses maltodextrins glucose syrups humectants, food acids additive and flavour carriers/ diluents	sauces, pickles and chutneys cooking oils, salad dressings margarines and spreads confectionery, fruit flavoured spreads savoury snacks herb and spices (through carriers and diluents)	1st US 2nd (4)	1st (most) 2nd (2)	1st (39) 2nd (6)
A380 Insect protected and glufosinate-ammonium tolerant DBT418	**N** (DNA)				4	41	45
A385 Insect-protected Bt-176 corn	**N**				4	41	45
A484 Insect-protected corn event MON863	**N** (DNA) • Starch; • Modified Starch;						

	• Meal; • Semolina; • Flour.						
					6	3	11 (2 N/O)
A346 Insect-protected corn line MON810	**N**				US	Most	53
A386 Corn Bt-11 Insect protected and glufosinate-ammonium tolerant	**N**				4	40	4
OIL FROM A388 bromoxynil-tolerant canola line Westar-Oxy-235	**N** (DNA)	**CANOLA**	canola oil lecithin	baked goods – cakes, pies, pastries salad dressings cooking oils margarines and spreads confectionery	US	MOST	US
A372 Glufosinate-ammonium tolerant canola lines Topas 19/2 and T45	**N** (DNA)				4	41	45
A372 Glufosinate-ammonium	**N** (DNA)				4	41	45

tolerant and pollination controlled canola lines Ms1, Ms8, Rf1, Rf2 and Rf3							
A363 Glyphosate-tolerant canola line GT73	**N**				US	US	US
OIL AND LINTERS FROM A379 bromoxynil-tolerant cotton containing transformation events 10211 and 10222	**N** (DNA)	**COTTON**	cotton seed oil (UL)	baked goods cooking oils salad dressings margarines	US	Most	US
A355 glyphosate-tolerant cotton line 1445	**N**				3	55	58
A341 insect-protected cotton lines event 15985 insect-protected cotton lines 531, 757, 1076	**N**				US	Most	86
A378 Glyphsate-tolerant sugarbeet line 77		**SUGAR BEET**	sucrose mono sodium glutamate (MSG)	dairy products – drinks, yoghurts, desserts bread baked goods – cakes, pies, pastries, biscuits soups sauces fruit drinks, soft drinks and cordials jams and preserves confectionery s	4	41	45

				avoury snacks			
A383 Insect and potato leafroll virus protected potato lines RBMT21-129, RBMT21-350, and RBMT22-82	**N**	**POTATO**	potato potato starch modified starch	soups sauces, pickles and chutneys confectionery, savoury snacks	4	41	45
A384 Insect and potato virus Y-protected potato lines RBMT15-101, SEM15-02, and SEM15-15	**N (DNA)**				4	41	45
A384 Insect-protected potato lines BT-06, ATBT04-06, ATBT04-31, ATBT04-36, and SPBT02-05	**N**				4	41	45

Source: Table originates Royal Commission Report on Genetic Modification 2001 p 184-5; supplemented by approved foods, source: FSANZ Standard 1.5.2, table to cl. 2, information from FSANZ Applications.
US = unstated

Appendix 4

Approved Genetically Modified Processing Aids and Food Additives*

and Their Use (in chronological order)

*Labelling Not Required

Processing Aids	**Purpose**	**Use**
alpha -Acetolactate decarboxylase	Removes diacetyl - an off flavour from fermentation.	Beer
Carbohydrate modifying enzymes: -Amylase, Hemicellulase endo -1, 4-. -xylanase or xylanase	Used to break down starch from cereals during manufacturing and sugar during refining, and to clarify fruit juices	Beer, spirits, glucose syrups, bread, sugar, enzyme modified starches, fruit juices
Fat modifying enzymes: Lipase, triacylglycerol	Applied to fats and oils to produce triglycerides which enhance spreadability or texture	Cheese and dairy products, chocolate and related confectionery
Protein modifying enzymes: Chymosin, Mucorpepsin	Coagulate milk proteins to: form curds in cheese making, and clot or thicken cream.	Cheese, Cream
Food Additives	**Purpose**	**Use**
460 Cellulose	Used as a bulking agent to add volume to a food without significantly contributing to its energy value	Many foods may contain cellulose including sauces and confectionery
1105 Lysozyme	Preservative action - breaks down bacterial cell walls	
322 Lecithin	Emulsifier prevents foods from separating either during manufacture or in package	Many foods including chocolate, margarine, table spreads, sauces and dips

Source: FSANZ Standard 1.5.2, attachment 2

Appendix 5: Australian Organic and Biodynamic Certification Authorities

Australian Quarantine and Inspection Service

Phone: (02) 6271 6638
Post: G.P.O. Box 858
Canberra ACT 2601
Web: http://www.daffa.gov.au/aqis

AUS-QUAL

Phone: 1800 630 890 or 07 3361 9233
Post: PO Box 3175
South Brisbane QLD 4101
Web:http://www.ausqual.com.au/index.html
Email: ausqual@ausqual.com.au

Bio-dynamic Research Institute

Phone: (03) 5966 7333
Post: C/O Post Office
Powelltown VIC 3797
Web: http://www.demeter.org.au/

Australian Certified Organic

Post: P.O. Box 530
Chermside QLD 4032
Phone: (07) 3350 5716
Web: www.australianorganic.com.au
Email: info@bfa.com.au

National Association for Sustainable Agriculture Australia

Phone: 08 8370 8455
Post: PO Box 768, Stirling SA 5152
Web: http://www.nasaa.com.au/welcome1.html
Email: enquiries@nasaa.com.au

Organic Food Chain

Phone: (07) 4637 2600
Post: P.O. Box 2390
Toowoomba QLD 4350
Web: www.organicfoodchain.com.au
Email: ofc@organicfoodchain.com.au

Organic Growers of Australia

Phone: (02) 6622 0100
Post: P.O. Box 6171
South Lismore NSW 2480
Web: www.organicgrowers.org.au
Email: oga@bfa.com.au

Safe Food Queensland

Phone: 1800 300 815
Post: P.O. Box 440
Spring Hill QLD 4004
Web: http://www.safefood.qld.gov.au/
Email: info@safefood.qld.gov.au

Tasmanian Organic-Dynamic Producers

Phone: (03) 6381 2004
Post: P.O. Box 13
Campbell Town TAS 7210
Web: www.tasorganicdynamic.com.au

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http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/F0F9E5FCC5898211CA256D740001012A/$File/46130_2003.pdf
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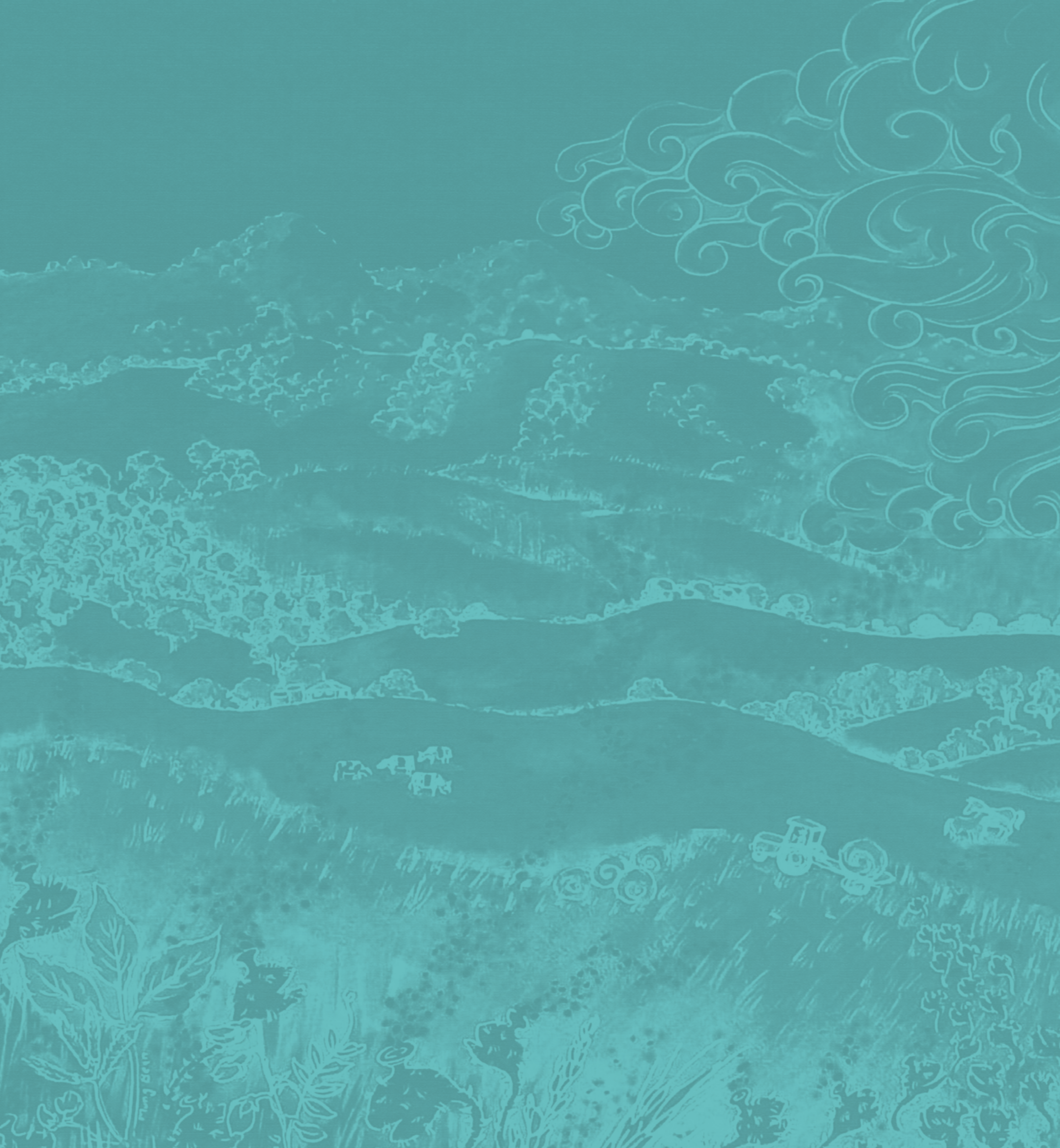

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