# RELEARNING FOOD:
# AGRICULTURAL LITERACY IN THE ELEMENTARY SCHOOL SCIENCE CURRICULUM OF NOVA SCOTIA

by

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**ABSTRACT**

This study uses manifest coding to review the Nova Scotia elementary school science curriculum guides for agricultural literacy content. The codes are derived from peer-reviewed definitions of agricultural literacy. Throughout the entire curriculum, twenty-four of the forty-eight codes emerge at least once. Agricultural literacy connections peak in grade 3 before falling to almost negligible numbers in grade 6. The most common agricultural subject area was "agriculture's relationship with the environment" followed by "the production of plant products." More complex issues such as the economic impact and marketing of agriculture are not present. The study concludes that students will attain enough information to know how to do basic gardening but rarely is the connection made to agriculture or food and fiber production.

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# CHAPTER 1

## 1.0 INTRODUCTION

In February 2012, Canada celebrated its first national Agricultural Literacy Week. Across Canada, organizations came together to encourage relationships between children and farmers. The goal was to connect children with the food that they eat because "In Canada, most families are two or three generations away from the farm" (Amason, 2012). Without industrial agriculture society would not have the convenience of easily available, safe, and affordable food. However, studies have found that the majority of children and adults are not agriculturally literate, which means that they do not understand the system that produces the food they eat (Barton, Koch, Contento, and Hagiwara, 2005; Dillon, Rickinson, Sanders, Teamey, & Benefield, 2003; Williams and Brown, 2012). Agriculture is fundamental to our society yet most people today are unaware of its importance. If we truly are what we eat, we had better start understanding ourselves better.

National Agricultural Literacy Week is not the beginning of the movement to reconnect children with food and agricultural practices; rather it is the culmination of years of discussion, research and action in the hopes of reconnecting people with the food they eat. In the late 1980s, the National Research Council recognized the importance of teaching children about agriculture at every grade level (National Research Council, 1988). In the mid 1990s, Oklahoma State University and the University of California created *A Guide to Food and Fiber Systems Literacy* to help K-12 teachers better administer agricultural lessons in the classroom (Leising, Igo, Heald, Hubert, & Yamamoto, 1998, p. 4). Across Canada, children are taught the importance of interacting with nature through agriculture by organizations like the Evergreen Foundation, Farm to School programs and 4-H. In the United States, the Department of Defense has already latched onto importance of agricultural literacy and funded Farm to School programs in varying states (Joshi, Kalb, & Beery, 2006). As agriculture is not a traditional domain within the Department of Defense, this development highlights the issue as more than a matter of introducing children to a healthier and fresher diet but also a matter of security.

Children form many of their ideas and beliefs about the world in elementary school (Balschweid, 2002; Braverman & Rilla, 1991; Hubert, Frank, & Igo, 2000; Waters, 2005; Wilson, 1996). Several researchers and advocates have stated the importance of agricultural literacy in the elementary school curriculum (Balschwied, 2002; Dillon et al, 2000; Hubert et al, 2000; Leising, Igo, Heald, & Yamamoto, 1995). Other studies show that agricultural concepts are beneficial to learning science and vice versa (Balschweid & Thompson, 2002; Conroy, Trumbull and Johnson, 1999; Mabie and Baker, 1996). Agricultural literacy in the formal education system is a topic of increasing importance and a significant amount of research is being done into the topic.

This thesis examines the presence of agricultural literacy in the elementary school science curriculum of Nova Scotia. In Chapter 1, the purposes and rationale for this study are introduced. Chapter 2 looks further in depth into the issue of agriculture's relationship to sustainable development and what agricultural literacy means for children, especially in elementary school. Then the research methods are reviewed. Nova Scotia elementary schools use standardized curriculum guides for science. In this study these were assessed using manifest coding. Manifest coding is a technique that assesses a type of media, or in this case a text, for visible surface content (Neuman, 2000, pg. 295). In Chapter 3, the findings are presented and discussed. Based on the findings, and discussion, recommendations are made for future study and development of agricultural literacy in Nova Scotia, including recommendations for further research.

### 1.1 BRIEF OVERVIEW OF PROBLEM

At a grocery store in North America today, one can find most anything that one wants. Never has food been more available and accessible than over the past half a century. Foods that were once only available in season are available year-round. Exotic fruits that would never grow in the northern hemisphere outside of a greenhouse are regular items on the grocery list. With all the choice and selection, most people are unable to tell you the origin of a single item on their plate.

Why does it matter that people understand where their food is coming from? Over the past two decades many national, international bodies and public figures have called for a re-assessment of the food system and society's relationship with food. In 1988, the National Research Council quoted Moore (1987):

> "Students should come to appreciate that the species providing our food and fiber are part of a vast web of life that functions as an integrated whole. Every species of plant and animal depends not only on its physical environment but on the biological component of the environment as well. All living creatures are part of the same cycles of matter and energy. Thus, education will be incomplete unless students learn what is essential for the lives of our crops, animals, and plants" (pg. 1).

The National Research Council then went on to say that "Beginning in Kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture" (p. 2). Beyond the inherent value of understanding the source of the substances that one puts into one's body, an informed population is necessary to create a sustainable food system. Proper knowledge and facts are a tool to making sustainable and healthy food choices.

As the world becomes figuratively smaller through mass communication, easier travel and increasing global trade, it has become ever more obvious that everything is part of a larger whole. The systems at work are complex and powerful. The components of the global system are diverse and dynamic. Yet there are certain things that connect us all and one of them is food.

Food is absolutely necessary for survival – as simple as that. Yet, 16% of the world, or 837 million individuals are categorized as hungry by the United Nations (United Nations Secretary General, 2011). Those in North America are incredibly privileged to have such easy access to food. Distribution inequalities due to unpredictable trade policies and weak economies lead to many of the areas of the world facing food insecurity (Food and Agricultural Organization, 2012, pg. 100). Cultivating the soils over and over and pushing for higher and higher yields is putting a strain on ecosystems and water supply (Millenium Ecosystem Assessment, 2005; Human Development Report, 2011). Food security is threatened to decrease as environmental factors such as land degradation due to agriculture are expected to boost world food prices 30-50% which is predicted to have the most impact on poor households (Human Development Report, 2011).

The agricultural system relies heavily on the global market of capitalism. However, several world leaders and economics are now saying that the current form of

capitalism that the market functions within is failing (Reyes, 2012). In response to the economic and environmental issues, some have called for society to eat only what is in season and has been grown within a certain distance (MacLeod & Scott, 2007). This prevents an unnecessary amount of greenhouse gas emissions from transportation and supports the local economy (Macleod & Scott, 2007). There are many areas of the world where the capacity to produce enough food to feed the entire local population does not seem to exist, and Nova Scotia is one of them (MacLeod & Scott, 2007). Society is dependent upon a system that is unsustainable environmentally and economically, and there are predictions that if it carries on down the same path, the future will be dismal (Human Development Report, 2011). These issues are critical so it is crucial that society understands the impacts that their food habits have on the world and act on them.

### 1.2 RESEARCH PURPOSE, QUESTION, AND OBJECTIVES

The research question for this project was "How much agricultural content is present in the Nova Scotia elementary school science curriculum?" Using this question as a guide, the objectives were to assess the agricultural literacy content in the Nova Scotia elementary school science curriculum and use those findings to suggest a stronger foundation for agricultural literacy development in Nova Scotia. Since the school system is regulated across the province and the large majority of children in Nova Scotia go to a public school, the school curriculum provides the most uniform educational medium that children are exposed to. The decision to focus this paper on science within the elementary school curriculum is based on the literature review findings that agricultural concepts in science lessons are beneficial for high achievement and improved learning (Balschwied, 2002; Roegge & Russel, 1990; Mabie & Baker, 1996; Conroy et al., 1999). Furthermore, science has been reported to be the most obvious subject in which to incorporate agricultural concepts as well the best way for students to absorb these concepts (Hubert, Frank & Igo, 2000). Children in primary school are at the most influential stage of their life so are receptive to having a change in beliefs and attitudes about agriculture and the food system due to education (Balschweid, 2002; Braverman & Rilla, 1991; Hubert et. al., 2000; Waters, 2005; Wilson, 1996). It is important to introduce students to the issues that they will face as adults.

The more informed that they are about food and agriculture, the more likely they are to make well informed choices, for themselves and the planet.

### 1.3 CONTRIBUTIONS

The findings of this study are intended to contribute to the development of a curriculum for Nova Scotia that incorporates enhanced agricultural literacy. Agricultural literacy has become a topic of interest for educators across the province of Nova Scotia who would like to see more agricultural topics incorporated into the curriculum. The results of this study show where such curriculum links to agriculture can be made, facilitating the creation of agricultural literacy guides, or development of an agricultural curriculum for elementary school. School gardens are becoming common as well, and the lists of activities and outcomes provided here show how a garden can be used to emphasize lessons in all subjects, including agriculture, in the curriculum.

# CHAPTER 2

## 2.1 LITERATURE REVIEW

### 2.1.1 GLOBAL SUSTAINABLE DEVELOPMENT

The United Nations initiated the World Commission on Environmental Development (commonly known as the Brundtland Commission), in 1983, to address the growing tension seen between the environment and development (Hauff, 2007). In 1987, the Commission produced a report entitled, *Our Common Future: A Global Agenda for Change* (Brundtland Commission, 1987). This report defines sustainable development as development that "meets the needs of the present without compromising the ability of the future generations to meet their own needs" (Brundtland Commission, 1987, Chapter 2, para. 1). The United Nations has since made sustainable development one of its main axioms. As it grew into a new global standard, individual countries, states and provinces have incorporated sustainable development into many policies. Nova Scotia joined the movement by passing the *Nova Scotia Environmental Goals and Sustainable Prosperity Act* in 2007. The act sets emission reduction goals and aspires to grow the local economy through environmentally informed innovation and technologies (Bill No. 146). Achieving these goals would require significant policy and lifestyle changes in Nova Scotia since the ecological footprint of Nova Scotia is an average of 8.1 ha. per person (Wilson, Colman, & Monette, 2001). In contrast, the ecological footprint per person globally available is 1.8 ha. (Wilson et al, 2001). Despite the global scale of the issues addressed by sustainable development, Nova Scotia and many other regions of the world have acknowledged that action must be taken locally, by individuals, institutions, and communities to create sustainable societies.

### 2.1.2 ROLE OF AGRICULTURE++++ IN SUSTAINABLE DEVELOPMENT IN NOVA SCOTIA

Globally, about 1.5 billion ha of land is used for agriculture, which is about 12% of Earth's total land mass (Food and Agricultural Organization, 2012, pg. 14). As the population grows, so does the land mass needed to create food to feed every person.

Industrialized farms use heavy machinery, pesticides, inorganic fertilizers and monoculture to obtain higher yields that are necessary to feed an expanding population (Pretty, 1995, p. 1247). This has resulted in an ever-decreasing percentage of undernourished people. However, agriculture has a severe toll on the biosphere, which includes water, air, animals, vegetation and soils. Industrial agriculture has caused widespread deforestation, pollution, and water depletion globally.

Additionally, due to the increase of industrial farms, small farm numbers are dwindling. Fewer workers are needed on industrialized farms so farmers are losing employment as their positions are replaced by more economically efficient technologies. In its most recent census from 2006, Statistics Canada (2009) found that though the number of farms is fewer, the total mass of agricultural land is remaining stable at about 67,582,500 hectares because individual farm sizes are growing. The census also found that farmers are spending more time in jobs outside of the farm, and fewer are farming full-time (Statistics Canada, 2009).

The Nova Scotian government has created a 'buy-local' initiative to help farmers maintain a steady income (Carter-Whitney, 2009, p. 14). The campaign, called "Select Nova Scotia", encourages Nova Scotians to consume as many local goods as possible. However, as pointed out by Macleod and Scott (2007), there may not be enough local food available for every Nova Scotian to buy only local food (2007, p. 40). Agricultural production has been declining in Nova Scotia. Buying locally grown and produced food is important to the sustainability movement, but a lack of available local produce makes the buy-local goal difficult to achieve. Millward (2005) suggests that King's County is the only area in Nova Scotia that can still be considered agricultural and, since 1891, the number of farms in Nova Scotia has declined by 96% (p. 188). A recent study found that Nova Scotian farms are losing economic viability (Scott and Colman, 2008b). As individuals struggle to support their families and themselves in the midst of an economic crisis, they need as much financial security as possible and farming does not appear to be able to provide it.

Rosset (2000) published a study about the importance of small farm agriculture to the world and its biosphere. When discussing the positive impact that small farms have in the western world, he notes the USDA's reasons for supporting small farms:

increased cultural diversity, biodiversity, environmental benefits, empowerment of individuals and community, places for families to grow safely, increased personal connection with food and keystones to the economy (USDA 1998, as cited in Rosset, 2000, pg. 78). Rosset also states that "small farmers are better stewards of natural resources, conserving biodiversity and safeguarding the sustainability of production" in comparison to large farms (2000, pg. 77). Industrial farming and the Green Revolution are linked to decreased biodiversity, especially depleting genetic biodiversity (Thrupp, 2002). Decreased biodiversity reduces the arability of the soil, so though industrialized monoculture can increase the current output on the farm, if not planned conscientiously, the degradation to the soil can have serious negative long-term effects. If the soil is not healthy, crop yields will decrease. Large-scale livestock farms can also be damaging to local ecosystems for the same reasons. As fewer and fewer individuals grow food, an increased dependence on earned income to provide food develops. Food security is decreased when people depend on money rather than food to survive because they become susceptible to fluctuations in employment, wages and food prices to live (Rosset, 2000, pg. 82). High and volatile food prices are likely to continue and this means decreased food security for those depending on their financial situations for their food (Food and Agriculture Organization, 2011).

In Nova Scotia, farmers contribute to the livelihood of their communities in many ways, as is made evident by Genuine Progress Index Atlantic (GPI Atlantic) in their interviews with members of rural agricultural communities in 2003. "Farmers *create* wealth," one respondent said, "which generates economic activities in the community" (Scott and Colman, 2008a, p. 12). Another describes the economic activity provided by small farms, "[W]hen the farmers have a good year, they put more money into the rink or the church or other community activities" (Scott and Colman, 2008a, p. 12). Small farms are more economically sustainable for small communities than industrial farms in that the farm's income is much more likely to remain and circulate within the local community. A survey of farmers in King's County showed that an average of 88% of farm expenses were spent within the county (Scott and Colman, 2008a, p. 18). These findings indicate that small farms make communities more economically sustainable.

Scott and Colman's report "Towards a Healthy Farm and Food System: Indicators of Genuine Progress" (2008b) states that losing one farm leads to: "direct and indirect loss of employment in a rural area, loss of training opportunities, loss of an important way to grow up and learn farming knowledge and skills, loss of potential farmers, and potential farm workers" (p. 87). When a farm is lost because no one has the interest in or capability of maintaining it, farming knowledge associated with that farm is also lost. The report also concentrates on the value of Nova Scotian farms in creating the "social capital" of "cultural memory that might help prevent or at least ameliorate the unraveling of social fabric in the larger society" where people are "basing their self-worth on what they buy rather than on their craft, vocation, and quality and diversity of relationships" (p. 153). Farming is a hugely important part of the Nova Scotian culture, and its rural community culture. It is key to the environmental, social and economic sustenance of rural communities.

### 2.1.3 YOUTH INTEREST IN AGRICULTURE

Most youth that enter the farming industry grew up on farms and 85% of these youth find that most farming knowledge is passed on from talking informally with other people (Scott and Colman, 2008b, p. 78). This knowledge of farming is invaluable. Martz and Bruckner (2003) as cited in Scott and Colman (2008b) surveyed Canadian farm families and found that "the range and amount of tasks that youth are involved in is amazing to those not from a farming background but commonplace for those who have grown up in a farming family" (p. 75). As fewer people become involved in agriculture, there are fewer ways of passing on important farming knowledge. Statistics Canada reports that the number of farming operators under the age of 35 decreased from 11.5% to 9.1% between 2001 and 2006 alone (Statistics Canada, 2009). This is the lowest number in recorded history (Scott & Colman, 2008b). However, this statistic only reflects the operators of the farm, not the employees of the farm, which may include youth. In 2003, the then president of the Nova Scotia Federation of Agriculture (NSFA) predicted that, by 2013, 60-70% of Nova Scotian farmers would retire (Scott and Colman, 2008b, pp. 75-6). Scott and Colman relate this trend to a decreasing economic viability of farms in Nova Scotia. A study from GPI Atlantic quoted the former president

of the NSFA again saying it is necessary "for the future of the industry to ensure new farmers are able to move into the field to replace those who will be retiring" (Scott and Colman, 2008b, p. 75-76). A good way to ensure that there are youth to replace the retirees may be to provide ample opportunities for knowledge transfer from the farmer to the child. Such activities were facilitated during the first National Agricultural Literacy Week (Amason, 2012).

### 2.1.4 AGRICULTURAL LITERACY VERSUS AGRICULTURAL EDUCATION

A movement to instill children with a better understanding of the agricultural system and the food they eat is underway in North America. An understanding of the food system is called *agricultural literacy.* When agriculture is taught in the context of the food system in schools it is often also referred to as *agricultural education*. For the sake of this paper, and with respect to the growing agricultural literacy movement, the two terms will be differentiated.

According to the United States National Academy of Sciences (1989), *agricultural literacy* can be defined "as education about agriculture … to include a person's understanding of the food and fiber system, its history and current economic, social and environmental significance" (as quoted in Desmond, Grieshop & Subramarian, 2002, p. 23). In comparison, it defines *agricultural education* as "a type of vocational education in agriculture which includes the development of the specific skills and knowledge necessary to become effectively employed in some aspect of the system of commerce that provides a society's food and fiber" (as quoted in Desmond et al., 2002, pg. 23). Braverman and Rilla (1991) also define *agricultural literacy* as "education *about* agriculture" versus *agricultural education* as "education *in* agriculture" (pp. 4-5). Another, more thorough, definition is provided by Frick, Kahler and Miller (1991):

> Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture. Basic agricultural information includes: the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products,

> public agricultural policies, the global significance of agriculture, and the distribution of agricultural products (p. 52).

Agricultural literacy is a more overarching term than agricultural education and provides information more useful to non-farmers. The basics of agricultural education can be contained within agricultural literacy; for example, knowledge about the best conditions under which to grow certain crops is part of both agricultural literacy and education. It is important for anyone interested in pursuing a career in agriculture to understand the system that they must work within, and that understanding should be provided by agricultural literacy. Moreover, it is important that consumers are aware of the food that they are buying and the effect that their choices can have on the global food system (Bisonnette & Contento, 2001, p. 72). Mieschen and Trexler (2003) developed an updated definition of agricultural literacy that goes beyond basic knowledge and understanding the ability to discuss agricultural concepts. Their definition of agricultural literacy is more value and judgment based: "At a minimum, if a person were literate about agriculture, food, fiber, and natural resource systems, he or she would be able to a) engage in social conversation, b) evaluate the validity of media, c) identify local, national, and international issues, and d) pose and evaluate arguments based on scientific evidence" (Mieschan and Trexler, 2003, p. 44). Agricultural literacy is an important step to making the informed food choices that can lead to a more sustainable future.

Powell, Agnew and Trexler (2008) sought to create a definition of agricultural literacy that would function best for practical application into educational frameworks. They agreed that the best way to achieve agricultural literacy it to develop a grass-roots or constructivist curriculum that builds upon what students already know and "use that knowledge in purposeful activities requiring decision making, problem solving, and judgments" (Powell et al, 2008, p. 86). Based on a model underscoring the complimentary values in three different education approaches, the authors devised that the best way to achieve this form of education is through incorporating agricultural topics into the current curricula, creating an agricultural curriculum and infusing it with traditional subject applications, and creating a value-based lesson plan about agriculture (Powell et al, 2008, p. 86).

### 2.1.5 IMPORTANCE OF PRIMARY SCHOOL EDUCATION

There is an overwhelming lack of the agricultural literacy necessary for society to question how its food system works and to improve it (Barton, Koch, Contento, and Hagiwara, 2005; Dillon, Rickinson, Sanders, Teamey, & Benefield, 2003; Williams and Brown, 2012). Today there is increasing evidence that people, including children, have increasingly distant relationships with the natural world (Hubert, Frank, & Igo, 2000; Nabhan and Tribble, 1994; Louv, 2005; Orr, 2005, Wilson, 1996). This distance represents a loss of appreciation for and understanding of the biosphere that allows humans to thrive by providing air and water, as well as food. Humans have manipulated the biosphere to provide more food through agriculture and, though this has a positive return by way of feeding more people, it is degrading the environment, and therefore human health, through greenhouse gas emissions, water depletion, pollution, and soil degradation. It is necessary that the interconnections of food, environment, and human well being become better understood.

Studies have shown that elementary school students (typically primary to grade 6) are at the age that is most likely to be receptive to influence of their beliefs and attitudes about agriculture and the food system (Balschweid, 2002; Braverman & Rilla, 1991; Hubert et al, 2000; Waters, 2005; Wilson, 1996). A younger person is more "susceptible to new thoughts and ideas" (Hubert et al., 2000). Agricultural literacy in children can play a role in sustainable development because it helps create citizens who are more informed to be making decisions about agricultural policy and it can also be used as a tool to repair the aforementioned distanced relationship that children have with nature and food. Wilson conjectures that the Western approach to nature removes children from direct contact with the natural environment and argues that instead children should be exposed to "frequent, positive experiences in the out-of doors during childhood" so that they have more "adaptive and sympathetic" attitudes towards the environment (Wilson, 1996, pp. 121, 123). Children should be introduced to the personal and societal interrelationship with the biosphere and the concept of sustainability at a young age to appreciate it. Hubert's study about agricultural literacy in the classroom from grades K-12 concludes, "K-3 are probably most influential" (p. 530). As Moore (1995) illustrates, children will be the ones making the decisions in the

future so they must be taught the "daily lessons of nature … with a matter of great urgency" (p. 68). Encouraging understanding that will be conducive to a sustainable lifestyle through elementary school education is incredibly important if society is to become more sustainable and people healthier.

### 2.1.6 BENEFITS OF AGRICULTURAL LITERACY TO EDUCATION

Agricultural literacy is important to a society whose survival depends so heavily on a complex agricultural system. Connecting food, something with which students are very familiar, to lessons makes it easier for students to understand and also helps them to see the importance of the agricultural system in all aspects of their lives. Acknowledging that knowledge will not always change certain attitudes, as addressed by Dillon et al (2003), it is important to understand that agricultural literacy has been demonstrated to improve attitudes and understandings about agriculture, farmers, food and general academic achievement. The U.S. National Research Council (1988) concluded that "Beginning in Kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture" after finding that there was not enough agriculture in the American school system and presenting the importance of understanding food (p. 2). Oklahoma State University and University of California developed a curriculum aid called *A Guide to Food and Fiber Systems Literacy* to help K-12 teachers better deliver agricultural content in the classroom (Leising, Igo, Heald, Hubert, & Yamamoto, 1998, p. 4). Pre-lesson and post-lesson test results given to kindergarten through grade twelve showed that students had a higher understanding of agricultural concepts after having lessons which used the guide for agricultural literacy (Hubert et al, 2000). Further studies by Igo, Leising and Frick (1999) and Leising, Pense, and Igo (2001) also show that lesson plans with the Food and Fiber Systems Literacy guide improved the agricultural literacy of students. Studies on the correlation between the number of connections to agriculture made by teachers and the agricultural literacy of students are conflicting. Igo, Leising, & Frick (1999) found that there is a positive relationship between the number of connections made to agricultural literacy and increases in student knowledge (p. 229). However, Leising, Pense and Igo (2001) used much the same framework and found that there was no correlation (p. 150). They

recommended further research into the subject before conclusions should be drawn (Leising et al, 2001, p. 150).

California has one of the most developed agricultural literacy programs in the western world, since most schools have agricultural literacy incorporated into their mandatory curriculum. In 1995, it was mandated that every school in California should have a student-tended garden to "create opportunities for our children to discover fresh food, make healthier choices and become better nourished" (Subramanian, 2002, p. 6). Moore's article (1995) about "Children Gardening" (1995) focuses on the Yard program, a program that incorporated gardening into the mandatory curriculum of a California school by planting a garden for the children to tend to (p. 69). It was introduced in cooperation with the University of California, Berkley and the Berkley School District (Moore, 1995). In the article, Moore describes the children's enthusiasm for food and gardening after participating in the garden. Gardening is only one way to achieve agricultural literacy; other ways include field trips, in class presentations, incorporating agriculture into regular class lessons, and farm to school programs.

As fewer youth become farmers, an equally worrisome trend exists in members of the public understanding less about rural life and environmental problems associated with agriculture than ever before (Dillon, Rickinson, Sanders, Teamey & Benefield, 2003, p.1; Knobloch & Martin, 2002, p. 13). Barton, Koch, Contento and Hagiwara's "From Global Sustainability to Inclusive Education: Understanding Urban Children's Ideas about the food system" (2005) found that children viewed food as a "commodity" produced by "business men" rather than "something produced by nature to nourish people" (p. 1169, 1182). Barton et al (2005) also found that children understood that the food system is complex but not the negative environmental impacts besides those associated with packaging (p. 1182). They further emphasized the need for agriculture in the classroom with their findings that that most children obtain their understanding of the food system from the television or home rather than school (p. 1182). This shows an obvious disconnect between the realities of agricultural damage to the biosphere and society's perception of such. As pointed out by Williams and Brown (2012), "it is necessary that children regain a tangible understanding of soil ... [and] seek to develop attributes of living soil into a metaphorical framework that can guide education toward

an ecological paradigm for sustainability" (p. 14). Teaching agricultural literacy can help clarify the issues and strengths of the agricultural system so that society can make this connection.

### 2.1.7 BENEFITS OF AGRICULTURAL LITERACY IN THE SCIENCE CURRICULUM

Much of the literature surrounding agricultural literacy in formal education demonstrates its positive effects on students' achievement when integrated with a science curriculum. Balschwied and Thompson (2002) found that 90% of the students surveyed agreed that participating in a biology class that incorporated agriculture helped them understand the relationship between science and agriculture (p. 361). About 88.6% agreed that their appreciation of the importance of agriculture and those who work in agriculture was a result of agriculture being incorporated into their biology class (Balschwied and Thompson, 2002, pg. 370). Roegge and Russel (1990) showed that high school students have a higher achievement in biology and more positive attitudes about the subject after agriculture is incorporated into the curriculum (p. 30). Conroy, Trumbull and Johnson (1999) and Mabie and Baker (1996) demonstrate that agriculture literacy in primary school improves an understanding of basic math and science amongst students. Furthermore, Conroy et al (1999) collected a panel of experts who deemed that agricultural literacy together with science and math can provide much needed lessons to prepare children for adulthood.

Conroy et al (1999) also points out that "learners fail to develop a deep understanding of science and mathematics in traditional classrooms and fail to apply this knowledge to settings outside of the particular classroom" (p. 5). With agricultural literacy, students can apply the science that they learned in class to their everyday lives. The capacity to do this makes the subject material for students much more interesting and is the most popular hypothesis for why student achievement improves when science and agricultural literacy are combined in the classroom. Agriculture needs science too, as science facilitates understanding (Hubert et al, 2000). Conroy et al (1999) claim that the field of agricultural education has nationally recognized the need to integrate the two subjects (p. 5). When taught together, science and agricultural

literacy can enable children to have a better understanding of the agricultural system as well as scientific concepts.

### 2.1.8 GARDEN-BASED LEARNING AND SCHOOL GARDEN CASE STUDIES

"Agriculture is, by nature, a hands-on discipline", write Mabie and Baker (1999, pg. 2). For children to best achieve agricultural literacy, it is important that they have some experiential learning in the garden or through some form of agriculture in the classroom, such as growing chicks or potted plants, to expand beyond traditional classroom education. School gardens, field trips to farms, and gardens in the classroom (rather than in the school-yard) go hand-in-hand with agricultural literacy programs in place across North America. Exposing students to gardening has proven to be beneficial for the student's academic achievement and well-being (Alexander, North, Hendren, 1995; Canaris, 1995; Desmond et al, 2002; Subramanian, 2002; Wilson, 1996) and therefore society as a whole. In 1995, California mandated that every school should have a garden to "create opportunities for our children to discover fresh food, make healthier choices and become better nourished" (Subramanian, 2002, p. 6).

Experiential learning encourages many different kinds of intelligences when compared to traditional forms of teaching. Gardner (1999) names eight kinds of intelligences, "linguistic, musical, logical-mathematical, spatial, bodily, kinesthetic, interpersonal, and intrapersonal" (Subramanian, 2002, p. 4). Of these, Gardner asserts, linguistic and logical-mathematical are given the most emphasis in curricula (Subramanian, 2002, p. 4). However, what has been found through studies on children who have participated in Garden-Based Learning (GBL) is that they exhibit (a) better performance on standardized achievement tests of reading, writing, math, social studies and science; (b) reduced classroom management and discipline problems; (c) increased attention and enthusiasm for learning; and (d) greater pride and ownership of accomplishments" (Desmond et al., 2002, pg. 40). Therefore, the benefits of agricultural literacy in the curriculum as demonstrated above could be even further improved upon if they are implemented along with gardening projects.

Canaris (1995) studied a school garden in Westminster, Vermont. One farmer took an interest in starting the garden to "keep a generation of children in touch with the

land and to teach them what it means to produce, buy and prepare healthy foods" (Canaris, 1995, pg. 135). Over the 11 years it took to plan, construct, and maintain a healthy garden, the students remained enthusiastic about the project. This study shows that having a hands-on project can increase morale, especially if they can acquire some sort of reward like fresh vegetables. Increased enthusiasm and interest in school increased academic achievement but students were also able to better grasp academic subjects by applying them to lessons in the garden. Not only did they get to help plant the garden but students were also part of the process of designing it. Participating students strengthened their skills in math, planning, community interdependence, and creating hypotheses as well as their over-all interest in attending school (Canaris, 1995).

Farm to School programs are very popular throughout the United States and were initiated by the Community Food Security Coalition (CFSC) and the Urban & Environmental Policy Institute (UEPI) in 2007 (National Farm to School Network, n.d.). These programs bring local food into the school cafeterias and often include lessons, presentations and field trips that focus on agricultural literacy. The Farm to School programs started for two reasons: to improve children's health and diet and because small, local farms were disappearing (Joshi, Kalb & Beery, 2006). The program exists in different capacities, depending on the state where it is implemented. In California, the school has a daily salad bar, with a harvest of the month program featuring a vegetable that is in season (Joshi et al, 2006). They have incorporated the program into the curriculum through field trips to farms, 'farmer in the classroom' presentations and workshops (Joshi et al, 2006).

In Florida, the New Florida Cooperative helped to organize the Farm to School program in their schools by selling the programs to farmers as a long-term market in which farmers will receive the highest prices for their products (Joshi et al, 2006). This agreement gave the farmers much more control over the price of their product and a promise of consistent clientele (Joshi et al, 2006). The Department of Defense funds the programs and gives specific consideration to including small-scale, local farmers in the programs compared to the farm to school programs funded by other agencies presumably hoping that promoting these programs will help to increase food security and sovereignty in America since agriculture falls outside of its typical domain (Joshi et

al, 2006). The Department of Defense also supports the Farm to School program in Michigan.

In Illinois, they have introduced an eight-week K-2 program called, "Local Food, Global Stories" (Joshi et al, 2006). The program includes farm tours, farmer presentations in the classroom and parent education sessions (Joshi et al, 2006). It hoped to "improve the eating habits of students, increase student knowledge about nutrition, health, agriculture and the environment, about how food is grown, and support local farmers raising food in ecologically responsible ways" (Joshi et al, 2006, p. 9). Similar programs also exist in Massachusetts and New Hampshire. The Farm to School programs have been successful in improving the participating student's eating habits and improving the income of local farmers (Joshi et al, 2006). The increase in small farms in America can perhaps be partly attributed to these programs as well.

Within Canada, the Evergreen foundation, a national not-for-profit, is working with schools and communities throughout the Canada to reconnect children with nature through planting gardens for students to enjoy and tend to on school grounds (Evergreen, 2012). With the help of this organization, schools can create curriculum activities that incorporate the garden. In Nova Scotia, 13 schools have implemented school ground greening projects with the help of Evergreen (Evergreen, 2012b). Programs such as these enable children to have an experiential learning experience that will benefit their learning and academic achievement. Furthermore, these programs also help to encourage a healthier lifestyle for students influenced by an understanding of society's role in and impact on the environment as well as the environment's impact on society and human health.

Oklahoma State University created the *Guide to Food and Fiber System Literacy* as a way to help infuse agricultural literacy into any curriculum from grades K-8 (Leising et al, 1995). It provided lesson plans for language arts, mathematics, science and social studies (Leising et al., 1995). The lessons plans were generated based on a set of benchmarks established by experts using the Delphi method to achieve the best set of benchmarks possible (Pense, Leising, Porillo, & Igo, 2005, p. 111). All lessons are available online and can be applied to any curriculum though they are divided by grade level. Pense et al. (2005) studies the effect that Agriculture in the Classroom (AITC) has

on students' agricultural literacy. They found that AITC did increase students' agricultural literacy within the five benchmarks created by the Food and Fiber System Literacy Framework: understanding agriculture; history, geography and culture; science, technology and environment; business and economics; and food, nutrition and health (Pense et al., 2005, p. 116). Each grade level differed in which benchmark was most present in the agricultural knowledge acquired through the lessons. Grade K-1 was most knowledgeable in the food, nutrition and health benchmark; grades 2-3 in the understanding agriculture benchmark; grades 4-5 in the science, technology and the environment benchmark and grade 6 in the history, geography and environment benchmark (Pense et al., 2005, p. 116). The test results from the classes that received AITC were compared to the classes that did receive any AITC and it was found that both groups were most knowledgeable in the same subject areas but that the classes given AITC had the highest test scores (Pense et al, 2005, p. 116).

### 2.1.9 AGRICULTURAL LITERACY IN NOVA SCOTIA

The Council of Ministers of Education Canada provides definitions for three forms of education: "education offered in classrooms (formal education) and in non-school setting, such as workplaces and religious organization (non-formal education), and the more general forms of communication (e.g., the mass media) that help shape the public awareness and attitudes (informal education)" (CMEC, 2010, p. 5). Agricultural literacy can be delivered effectively through all three kinds of education. There are many non-formal agricultural literacy programs available in Nova Scotia that children and youth may participate in during their spare time. These include the 4-H programs, community gardens, and the Nova Scotia Young Farmers Forum. In February 2012, Nova Scotia celebrated its first Agricultural Literacy Week, during which farmers visited classroom to read to students about the importance of farming. Many schools across Nova Scotia have incorporated schools gardens with the help of Farm to Schools and the Evergreen Program. As of yet, the Nova Scotia formal public school curriculum has not been reviewed for agricultural literacy, which is the goal of this research project.

A GPI Atlantic report recommends a content analysis of school curricula in Canada because it "is one of the most important ways that public schools, as state

institutions, 'reproduce the existing culture' and reinforce 'the modern mindset'" (Pannozzo et al., 2008, p. 49). Formal education provided by public schools can "reproduce the existing culture and reinforce the modern mindset" because what they teach is important to the surviving in the existing status quo. Public schools have the power to guide the belief systems at the stage in an individual's life when they are the most influential. Moreover, Pannozzo et al's study recommends that the Nova Scotia curriculum be reviewed specifically for key literacies, including food and nutrition literacy (Pannozzo et al., 2008, p. 50). The report defines food and nutrition literacy concepts as:

> food safety and regulatory systems, the implications of long-distance transportation of food products, the nature and impact of food additives, the actual nutritional values of foods, the implications of agri-business production for local and global farmers and economies, the treatment of farm animals, and the environmental impacts created by food production systems, including understanding of the toxic residues of chemical farming and potential soil degradation resulting from intensive agriculture practices. Knowledge of topical issues, such as genetically engineered food products and organic foods, is also considered integral to food and nutrition literacy (Pannozzo, 2008, pg. 107).

This definition is very broad and falls within the broader understanding of agricultural literacy.

In order to understand how individuals learn about a subject, or agricultural literacy in this case, it is best to start from the broadest context. The formal education curriculum than expands across the entire province of Nova Scotia. It is important to review formal education because this is the most consistent forum in which agricultural education is delivered due to the fact that the curriculum used in schools in Nova Scotia is mandatory. Non-formal and informal education an individual receives is influenced by the choices that individual makes (ie. what television station to watch; what clubs to join) and more difficult to review on a uniform basis. As grades one through six are recognized as the most influential for delivering agricultural literacy, this study focused only on these grades. This study reviewed the science curriculum only, as science compliments agricultural literacy better than any other subjects. With the findings from this literature review taken into account, I reviewed the Nova Scotia public school science curriculum from grade 1 through grade 6 for indications of agricultural literacy.

## 2.2 RESEARCH METHODS

This study used a qualitative research approach to evaluate the presence of agricultural content in the Nova Scotia Elementary School Science curriculum. The research question that guided the study is: "*How much agricultural literacy is found in the Nova Scotia elementary school science curriculum?*".

The project used content analysis as the primary research method, and was informed by Spence (2011) who conducted a similar study examining environmental education in Nova Scotia's sixth-grade curriculum. Neuman (2000) defines content analysis as a "technique for gathering and analyzing the content of text. The content refers to the works, meanings, pictures, symbols, ideas, subject areas, or any message that can be communicated. The *text* is anything written, visual, or spoken that serves as a medium for communication" (p. 292). Content analysis was used to review the curriculum because it was the best way to obtain an objective analysis of the Nova Scotia public school curriculum, which is a very qualitative series of documents. The Nova Scotia curriculum documents are used in every public school across the province; therefore they are representative of the entire primary school system.

This study reviewed the Primary School Science Curriculum for Atlantic Canada from Grades 1 through 6. This curriculum reference includes six documents: *Science 1; Science 2; Science 3; Science 4; Science 5;* and *Science 6.* All of these documents were analyzed. Supplementary curriculum documents, such as *Let's Explore Plants and Soils* (Nova Scotia Department of Education, 2010) and *Science Olympics* (Nova Scotia Department of Education, 2009) were reviewed so that consistency was achieved by eliminating discrepancies in the uses of the curriculum documents. All documents were downloaded from the Nova Scotia Department of Education website.

The documents were analyzed using an *a priori* coding scheme. Manifest coding, with research codes was employed. Research codes are "the visible, surface content in a text … For example, a researcher counts the number of times a phrase or word (e.g., *red*) appears in a written text" (Neuman, 2000, p. 295). Codes were developed after an extensive review of the agricultural literacy. The codes were applied to each curriculum document, and each document was then treated as a *unit of analysis*. A *unit of analysis* is "the amount of text assigned a code" (Neuman, 2000, p. 296).

There are some limitations to the use of manifest coding. It is useful for reading the surface value of a text, specifically whether the codes are or are not present but it cannot be used to find the deeper meaning of the text (Neuman, 2000, p. 295). Therefore it is not possible to deduce the author's desired outcomes regarding agricultural literacy merely by reading the curriculum. Although there are no studies indicating the ideal frequency of agricultural content in curricula, the frequency of agricultural content can be interpreted as indicative of the amount of agricultural content presented to students in the province. Furthermore, the findings may be used to suggest where in the curriculum more agricultural literacy might be added and at which points agricultural literacy is a key part of the lesson plans.

The codes created for analysis were developed from the definition of agricultural literacy by Frick, Kahler, & Miller (1991):

> Agricultural literacy can be defined as possessing knowledge and understanding of our food and fiber system. An individual possessing such knowledge would be able to synthesize, analyze, and communicate basic information about agriculture. Basic agricultural information includes: the production of plant and animal products, the economic impact of agriculture, its societal significance, agriculture's important relationship with natural resources and the environment, the marketing of agricultural products, the processing of agricultural products, public agricultural policies, the global significance of agriculture, and the distribution of agricultural products (p. 52).

This was the most thorough definition of agricultural literacy found in the literature review and includes further categories labeled as "Eleven Agricultural Literacy Subject Categories and their Respective Subareas" (Frick et al., 1991, p. 55). The subject categories were determined via a survey of 67 panelists from a variety of fields including the agricultural industry, elementary and secondary education, and higher education (Frick et al, 1991, p. 50). Though this study is from 1991, the agricultural concepts presented are still relevant today. To be as thorough as possible, these subcategories were combined with the indices for Food and Nutrition Literacy in Nova Scotia created by GPI Atlantic and used as coding categories (Pannozzo, Hayward, K, & Colman, 2008, pg. 107). See Appendix 1 for a list of the subcategories. Appendix 2 contains the list of GPI indices. Frick et al.'s categories were used for subject areas and GPI's information was used to create more codes. Together, the two sources produced a

list of 41 codes that cover the wide scope of agricultural education (See Appendix 3). These codes were used to assess the extent to which the Nova Scotia Primary Science Curriculum promotes agricultural literacy. The outcomes of each grade level, the strategies for reaching those outcomes, the curricular resources and the recommended activities were all coded separately using the same codes. The number of outcomes and activities related to agricultural literacy were recorded by grade level. The number of times that activities leading to agricultural literacy occurred in the suggested strategies and tasks of every grade level were recorded as well. Emerging codes that had not been identified before the content analysis were also recorded based on relevance to agriculture, relevance to the problem of agricultural illiteracy and occurrence in the curriculum. Each code and its page location in the curriculum guide documents were recorded. The information gathered was used to determine how much agricultural content was presented in each grade.

# CHAPTER 3

## 3.1 FINDINGS

The Nova Scotia Elementary School Science Curriculum is based on the *Foundation for the Atlantic Canada Science Curriculum* (1998), which draws from the pan-Canadian *Common Framework of Science Learning Outcomes* (1997). Each of the six grade levels has a specific set of outcomes, and for each outcome there are suggested strategies that teachers may use to create "learning experiences and assessment tasks" (Department of Education, 2005, pg. v). Finally, teachers are provided with guides to activities that help engage students in the curriculum. For grades 1to 6 the curriculum also identifies key-stage curriculum attitude outcomes, one of which is stewardship. This is the only attitude outcome identified which relates to the agricultural literacy codes. Only the mandatory curriculum documents were assessed, as these are the documents every teacher must use to guide their lessons. Supplementary materials are also available to teachers but to maintain consistency, as their use is not mandatory, they were not reviewed.

Each curriculum document was broken down into three units of analysis: 1) Specific Curriculum Outcomes, 2) Suggested Teaching Strategies and Tasks, and 3) Suggested Teaching Activities. In total, 24 of the *a priori* 48 codes identified were found at least once in the outcomes, strategies and tasks, or activities in the science curriculum from grade 1 to 6. See Appendix 4 for the complete list of codes present. For a list of the codes not present in the guides, see Appendix 5. Throughout this thesis, subject areas are presented in *italics* and the codes in "quotations". After reviewing the curriculum, it is apparent that two of the subject areas coded for are not present in the elementary grades science curriculum: *economic impacts of agriculture* and *the marketing of agricultural products*. Therefore they are not discussed any further.

While reviewing the curriculum for the *a priori* set of codes, note was taken of words and phrases related to agriculture but do not match any of the identified subject areas or codes. The noted words and phrases were considered to be emerging codes and the curriculum was then reviewed a second time using these codes. The emerging codes identified were: "understanding weather", "the impact of agriculture on the environment", "identifying animals", "identifying plants", "visits to the farm",

"schoolyard exploration", "student-tended gardens", "animals in the classroom", and "plants in the classroom".

The code for "understanding weather" was chosen not only for its importance in agricultural literacy but also because it was a very common topic among the grade levels. Weather could easily fall under the subject area 'agriculture's relationship with natural resources and the environment'. When coding for 'understanding weather', it was assumed that students would learn what weather is associated with what season and/or the effects of weather on agriculture through the activity.

The "impact of agriculture on the environment" could not be properly coded for under any of the given codes though it was similar to the themes *agriculture's relationship with the environment* and *agriculture's relationship with natural resources*. This code was present for the times when the connection between agriculture and the environment was made directly without alluding to climate change or natural resources.

"Identifying animals" and "identifying plants" are basic concepts in agricultural literacy. Consumers of agricultural products should be able to properly identify what they are consuming. Though such basic lessons may be unnecessary in some of the more advanced grade levels, children must know the basic species in order to make informed choices in the future. The ability to identify animals and plants can also help children to understand the needs and growing conditions of different species. This broadens a child's understanding of what can grow where and at what time.

"Visits to the farm", "schoolyard exploration", "student-tended gardens", "animals in the classroom", and "plants in the classroom" are all codes representing opportunities for experiential learning. All these codes, with the exception of "student-tended gardens", were found in the curriculum. Student-tended gardens referred only to outdoor gardens for which students were responsible. Curriculum suggesting plants grown indoors was coded as "plants in the classroom". Having plants and animals in the classroom can be beneficial for understanding the development of the organisms. "Schoolyard exploration" occurs when teachers take students outside and often beyond the schoolyard into the surrounding neighborhoods and community to examine local natural phenomena. "Visits to farms" were designated as an emerging code because often a visit to a farm was recommended but did not fall under any of the previously

established codes. Visiting a farm is a very important part of experiential learning associated with agricultural literacy because it gives the students an opportunity to see how a farm works first hand, be it an animal or plant farm.

### 3.1.1 PRESENCE OF AGRICULTURAL LITERACY IN SPECIFIC CURRICULUM OUTCOMES

The science curriculum in each grade level is broken down into three or four units, each of which has different outcomes. Some units' outcomes, such as the "Exploring Soils" unit in grade 3, are very focused on agricultural literacy. Other units, such as "Invisible Forces", also a grade 3 unit, have no outcomes related to agricultural literacy. The subject areas *processing of agricultural products* and *public agricultural policies* are not represented in any of the specific curriculum outcomes.
Figure 1 shows the percentage of agricultural literacy related outcomes of the total number of learning outcomes presented in grades 1 to 6.

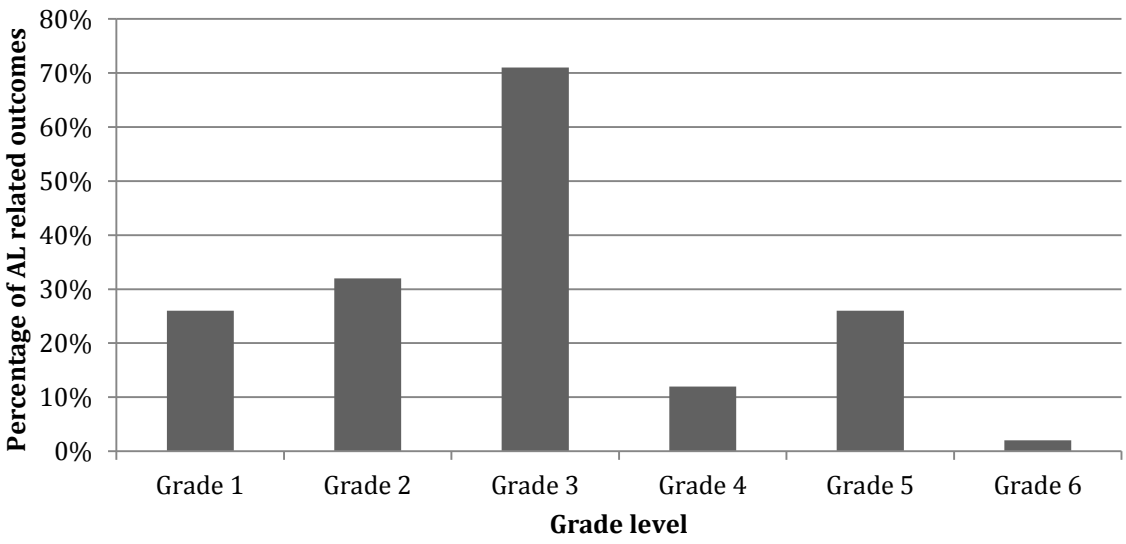


**Figure 1: Percentage Representation of Agricultural Literacy Outcomes in Nova Scotia Elementary Science Curriculum Sorted by Grade. Percentage numbers are: 26% (grade 1), 32% (grade 2), 71% (grade 3), 12% (grade 4), 26% (grade 5), 2% (grade 6).**

Figure 1 shows a spike in agricultural literacy outcomes in grade three. Grade 1 science curriculum is made up of three units: Physical Science: Materials, Objects and Our Senses; Life Sciences: Needs and Characteristics of Living Things; and Earth and Space Sciences: Daily and Seasonal Changes. In total nineteen learning outcomes are

identified in the grade 1 curriculum and five of these were related to agriculture. Three outcomes in the Life Science unit relate to agriculture. One was coded for "agriculturalist's role in protecting the environment" in the subject area of *agriculture's relationship with the environment* and the other two were coded for the emerging codes "identifying animals" and "identifying plants". The Earth and Space Science unit includes two outcomes related to agriculture, both of which pertain to the emerging code "understanding weather".

Grade 2 science has twenty-eight identified learning outcomes presented in four units: Physical Science: Relative Position and Motion; Physical Science: Liquids and Solids; Earth and Space Science: Air and Water in the Environment; Life Science: Animal Growth and Changes. Eight outcomes related to agricultural literacy were identified. Physical Science: Liquids and Solids included one outcome pertaining to "pollution and depletion of natural resource" from the subject area *agriculture's relationship with natural resources*. The Earth and Space Science unit has three outcomes related to agriculture. Two outcomes coded for "water" in the subject area of *agriculture's relationship with the environment*, another coded for "conservation of natural resources" under the subject area *agriculture's relationship with natural resources* and the third related to the emerging code "understanding weather". The Life Science unit was found to have four outcomes related to agricultural literacy. Three of the outcomes were coded for "the treatment of farm animals" under the subject area *production of animal products* and one outcome was coded for "awareness of own nutritional behaviour" under the subject area *societal significance of agriculture*.

Grade 3 science has thirty-one identified learning outcomes presented in four units: Life Science: Plant Growth and Changes; Earth and Space Science: Exploring Soils; Physical Science: Invisible Forces; Physical Science: Materials and Structures. Twenty-two of these outcomes were found to be related to agricultural literacy. In the Life Science Unit, all seven outcomes relate to agricultural literacy, under the subject area of *production of plant products* and one was also coded for the subject area *agriculture's relationship with the environment*. Of these seven outcomes, three were coded for "agronomic practices", four for "use and care of plants", and two for "greenhouses/gardens". In the Earth and Space Unit, six of the seven outcomes were

found to be related to the subject area *agriculture's relationship with the environment* and one coded for *production of plant products*. All six learning outcomes were found to include the "soil" code, three the "water" code, and one the "agronomic practices" code.

In fourth grade science there are four units with thirty-three identified learning outcomes. The units are: Life Science: Habitats; Physical Science: Light; Physical Science: Sound; and Earth and Space Science: Rocks, Minerals, and Erosion. Only three of the thirty-three outcomes were found to relate to agricultural literacy. Two were in the Life Science unit. One pertains to "technology and university research" from the subject area *global significance of agriculture* and the other "biodiversity" from the subject area *agriculture's relationship with the environment*. In the Earth and Space Science unit, one outcome was coded for "soil" within the subject area *agriculture's relationship with the environment*. The same outcome was also coded for the emerging code: "understanding weather"

The four units which make up grade 5 curriculum are: Earth and Space Science: Weather; Physical Science: Forces and Simple Machine; Life Science: Meeting Basic Needs and Maintaining a Healthy Body; and Physical Science: Properties of and Changes in Materials. Thirty four learning outcomes are identified for science curriculum for this grade. Of these a total of nine outcomes were found to relate to agricultural literacy. In the Earth and Space Science unit, two outcomes relate to "water" and one to "soil", so both fall under the subject area of *agriculture's relationship with the environment*. Seven of the outcomes in the Earth and Space Science unit relate to the emerging code "understanding weather". One other outcome in the Earth and Space Science unit was coded for "technology and university research" in the subject are of *global significance of agriculture.* The final outcome related to agricultural literacy was found in the Life Science unit under subject area of *societal significance of agriculture* and with the code "awareness of own nutritional behaviour".

In grade six, thirty-two learning outcomes are identified from four science program units: Physical Science: Electricity; Physical Science: Flight; Earth and Space Science: Space; and Life Science: Diversity. Two outcomes were found to relate to agricultural literacy through the emerging code "identifying plants". For a complete list

of the outcomes related to agricultural education, see Appendix 6. To see a tabular representation of these numbers, see Appendix 7.

Below, Figure 2 illustrates the dispersal of the main agricultural literacy subject areas throughout the outcomes.

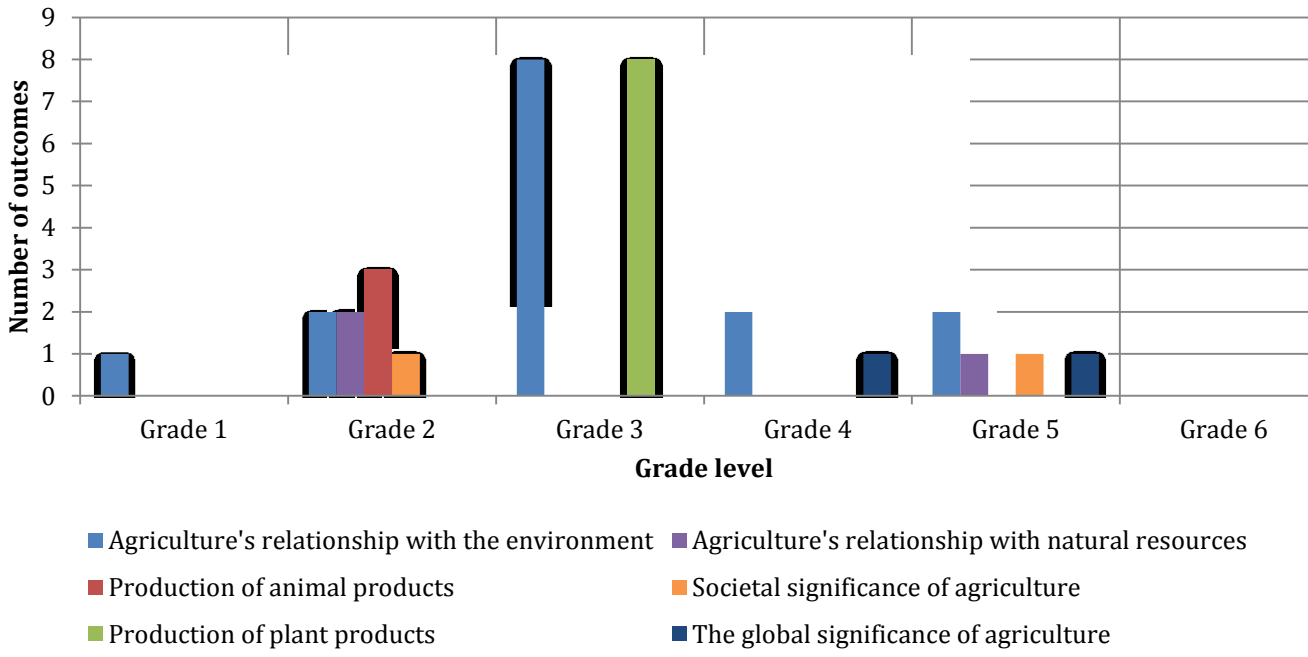


**Figure 2: Agricultural literacy outcome numbers sorted by subject area and grade**

Figure 2 shows which agricultural literacy subject areas were most prevalent through the elementary school science curriculum excluding the emerging codes. *Agriculture's relationship with the environment* was found to be the prevailing subject area. It was present in at least one outcome per grade level except grade 6. Other subject areas that were identified in the learning outcomes included *agriculture's relationship with natural resources* (in grade 2 and 5), *societal significance of agriculture* (in grades 2 and 5), *production of plant products* (in grade 3), and *the global significance of agriculture* (in grades 4 and 5).

### 3.1.2 PRESENCE OF AGRICULTURAL LITERACY IN SUGGESTED TEACHING STRATEGIES AND TASKS

Suggested teaching strategies and tasks are grouped together in the curriculum guides. The strategies provide "elaboration of outcomes listed … and described learning

environments and experiences that will support student's learning" (Atlantic Canada Science Curriculum: Grade 1, 2005, pg. 19). The tasks and assessments section "provides suggestions for ways in which students' achievement of the outcomes could be assessed" (Atlantic Canada Science Curriculum: Grade 1, 2005, pg. 19). Some of the suggested tasks include, "informal/formal observation, performance, journal, interview, paper and pencil, presentation, and portfolio" (Atlantic Canada Science Curriculum, 2005, pg. 19). The strategies and tasks were coded for the number of times a code appears, as opposed to how many strategies and tasks contained agricultural literacy[1]. Figure 3 depicts agricultural literacy codes present in grades 1 to 6 science curriculum strategies and tasks.

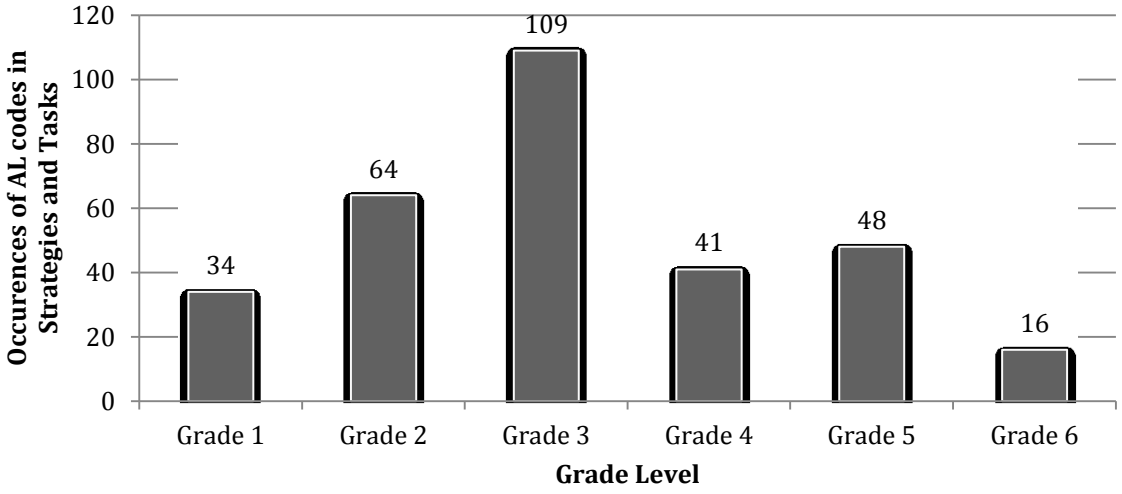


**Figure 3: Incidences of Agricultural Literacy in Strategies and Tasks of Nova Scotia Elementary Science Curriculum Sorted by Grade**

Agricultural content is shown to increase from grade 1 to 3 then diminish significantly in grade 4,. Grades 1 and 6 had the least amount of agricultural literacy content. In grade 1 the most prevalent codes identified pertained to the *production of plant products*: "greenhouse/gardens" and the "use and care of plants". The subject area *agriculture's relationship with the environment* was not found to be represented at all, though it is present at every other grade level. Other subject areas found within grade 1 science

[1] The code 'soil', under the subject area of agriculture's relationship with the environment, was counted by paragraph rather than occurrence in The Exploring Soils unit in grade 3 due to an extremely high prevalence rate.

curriculum were *agriculture's relationship with natural resources*, *the production of animal products*, and *the global significance of agriculture*. Several emerging codes were also present. "Understanding weather" was found twice in the Earth and Space Science Unit. "Identifying animals", "identifying plants", "visits to the farm", "schoolyard exploration", "animals in the classroom" and "plants in the classroom" were all identified within the Life Science unit.

The most common agricultural literacy codes found in grade 2 were "water" (mentioned fifteen times), "conservation of our natural resources", "pollution and depletion of our natural resources" (mentioned six and four times respectively) and "the treatment of farm animals" (mentioned eight times). "Awareness of own nutritional behaviour", under the subject area *societal significance of agriculture* subject area, was mentioned four times. Again, the emerging codes were very common: "understanding weather" sixteen times, "identifying animals" twice, "identifying plants" once, "visits to the farm" once, "school yard exploration our times, and "animals in the classroom" three times.

In grade 3, the science curriculum is broken down into two units in which every corresponding outcome could be coded for agricultural literacy. The two units are "Plant Growth and Changes" and "Exploring Soils". Of the codes from these units, sixty-nine fell under *agriculture's relationship with the environment* and twenty-five were found to be within the subject area *the production of plant products*. The codes reveal what aspects of the subject areas are being taught. In the sixty-nine times that *agriculture's relationship with the environment* was mentioned, only three of the nine codes were identified. Those were: "the agriculturalist's role in protecting the environment" (five times), "water" (twelve times) and "soil" (fifty-two times). Other subject areas addressed in grade 3 are *the processing of agricultural products*, *agriculture's relationship with natural resources*, *societal significance of agriculture*, and *the production of plant products*. Four of the emerging codes were found to be present: "identifying plants" six times, "visits to the farm" twice, "schoolyard exploration" three times, and "plants in the classroom" eight times.

After grade 3, the presence of strategies and tasks related to agricultural literacy in the science curriculum was observed to diminish significantly. Never the less

in grade 4 the presence of agricultural literacy codes was no lower than in grade 1. In grade 4, *agriculture's relationship with the environment* was mentioned ten times, and the codes for *agriculture's relationship with natural resources* were mentioned eight times. Codes for *the production of plants* were found five times and the "technology and university research" code is found twice. Emerging codes present in grade 4 were "understanding weather" ( five times), "the impact of agriculture" (once), "schoolyard exploration" (six times), "animals in the classroom" (once), and "plants in the classroom" (once).

The emerging code "understanding weather" was counted thirty-five times in grade 5 science curriculum . Other subject areas covered included *agriculture's relationship with the environment*, *the societal significance of agriculture*, and *the societal significance of agriculture.*

In grade 6, "water" was coded twice, "product development and technology" three times and *the production of plant products* once. Emerging codes were present but most were found in the same two pages, out of a total of 204 pages in the document so they do not make up a large proportion of the curriculum. The codes found were "understanding weather", "identifying animals", "identifying plants", and "schoolyard exploration". The numbers of incidences and corresponding codes for strategies and tasks can be found in Appendix 8.

Figure 4 illustrates the influence that the two units in grade 3 had on the resulting numbers and graphs by mapping out the subject areas present throughout the grade levels. The chart does not include the numbers of emerging codes.

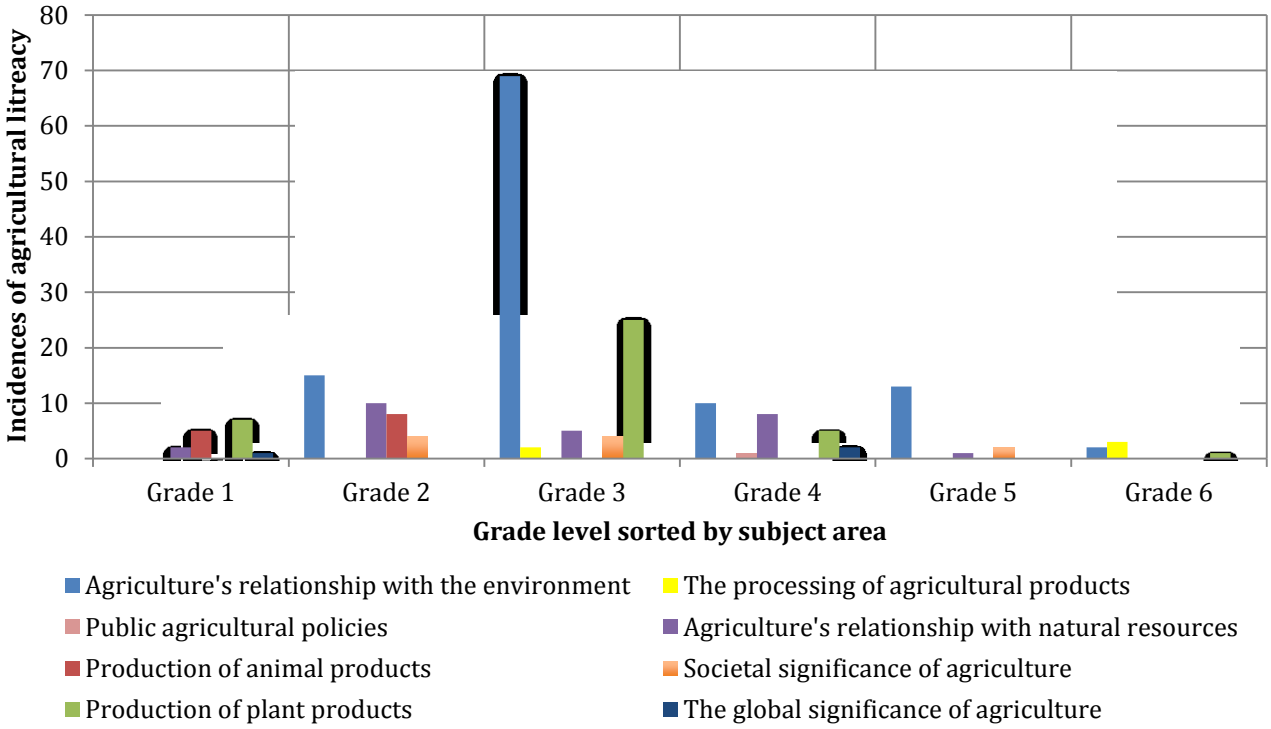


**Figure 4: Agricultural Literacy in Nova Scotia Elementary Science Curriculum Strategies and Tasks Sorted by Subject Area**

This chart shows the significant decrease in agriculture literacy related content and activities in grades 5 and 6, and also the impact that the "Exploring Soils" unit had on apparent agricultural literacy content in grade 3. It also demonstrates, when compared to figure 4, that when the emerging code numbers are taken into account, the amount of agricultural literacy at each grade level is significantly changed, especially in grade 5.

### 3.1.3 PRESENCE OF AGRICULTURAL LITERACY CONTENT IN SUGGESTED ACTIVITIES

The documents outlining science curriculum for each grade level includes an appendix listing suggested activities relevant to the subject matter and outcomes of the grade. For each activity information is provided on expected learning outcomes, assessment tools, questions to ask during the activity, materials to use for the activity, the procedure and any supplementary activity sheets needed. For a list of each activity related to agricultural literacy see Appendix 9.

This section of the thesis presents the agricultural literacy codes found in each science curriculum unit of each grade. The subject areas are presented graphically to show the common agricultural themes throughout the activities. Figure 5 presents the percentage of science curriculum activities in each grade level which relate to agricultural literacy. For a tabular representation of these numbers, see Appendix 10.

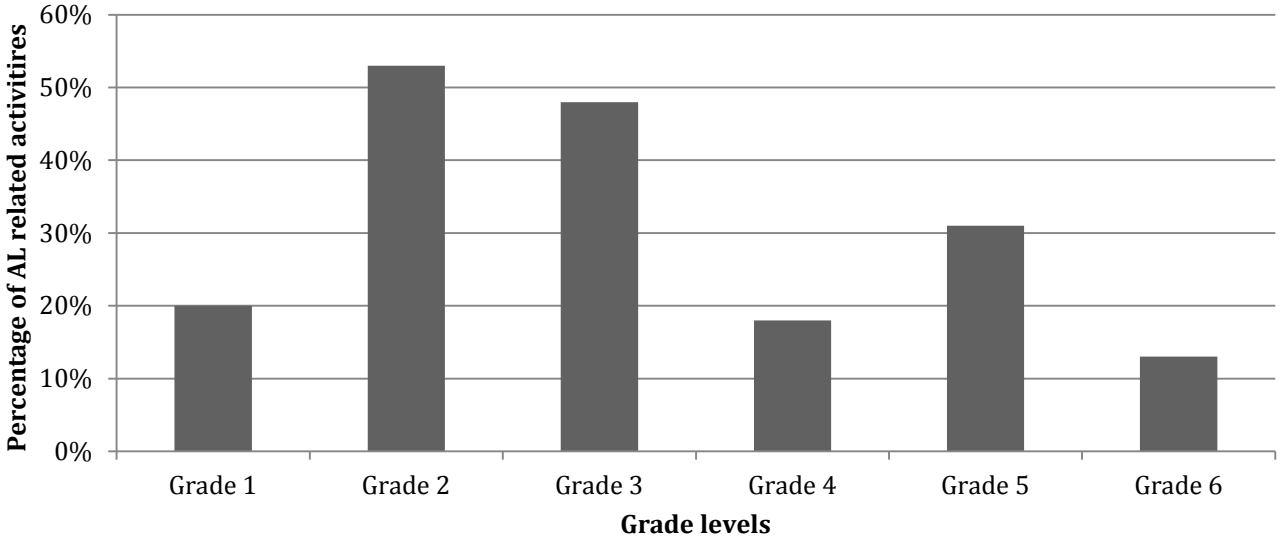


**Figure 5: Percentage Representation of Agricultural Literacy Related Activities in Nova Scotia Elementary Science Curriculum Sorted by Grade. The total percentage of agricultural related activities in grade 1 science is 20%; in grade 2 it is 53%; in grade 3 it is 48%; in grade 4 is it 18%, in grade 5; it is 31% and in grade 6 it is 13%.**

In grade 1 science, there are fifty-five activities, eleven of which were found to be related to agricultural literacy. In the Physical Science Unit, one activity relates to "food safety and regulatory standards". In the Life Science Unit, five activities were coded for "use and care of plants", one coded for "pollution and depletion of natural resources", and one coded for "water". Within this unit the emerging code "exploring the schoolyard" occurred once, and the codes "identifying "animals" and "identifying plants" were each found once. In the Earth and Space Science Unit, three activities included emerging codes: two related to "schoolyard exploration" and one related to "understanding weather".

Grade 2 science includes fifty-nine suggested activities of which thirty-one were found to relate to agricultural literacy. In the Physical Science Unit, five activities were relevant to agricultural literacy. One activity coded for "pollution and depletion of

natural resources" and also for "water". Three activities were found to relate to "understanding weather". In the Earth and Space Science Unit, there were fifteen agriculture related activities. One activity was coded for "treatment of farm animals", eight were coded for "water", four were coded for "pollution and depletion of natural resources", one was coded for "conservation of natural resources" and two were coded for the "use and care of plants". Five were coded for "understanding weather", three were coded for "schoolyard exploration", and one for "plants in the classroom". In the Life Science Unit, six activities were linked to agriculture. Three were coded for "treatment of farm animals", two for "agriculturalist's role in protecting the environment", and one for "awareness of own nutritional behaviour". There were five activities that involved "animals in the classroom", and two that involved "schoolyard exploration" .

In grade 3 science there are fifty suggested activities and twenty-four of them were found to relate to agricultural literacy. In the Life Science unit, there were nine activities related to agricultural literacy. Two were coded for "soil", one included content relating to "agriculture's effect on society", one contained content related to the code "where food comes from" and all nine were coded for "use and care of plants". The emerging codes were well represented. "Plants in the classroom" was found in five activities, "schoolyard exploration" was found in two, and "identifying animals", "identifying plants", and "visits to the farm" were each found once. In the Earth and Space unit there are 13 activities and each one was found to include activities relevant to "soil". Two also contained "water", and three contained the code for "use and care of plants". The emerging codes present were: "understanding weather" in three activities, "schoolyard exploration" in two and "visits to the farm" in one.

The four units in grade 4 science include seventy-nine suggested activities fourteen of which were found to relate to agricultural literacy. The Life Science unit contained twelve of these activities. One of the activities included content relating to "pollution and depletion of natural resources", the "codependent relationship between agriculture and natural resources", "agriculture's role in protecting the environment", "herbicides", "pesticides", "water", and finally, "technology and university research". This single suggested activity covered the subject areas of *agriculture's relationship with*

*the environment*, *agriculture's relationship with natural resources, the societal impact of agriculture*, and *the global significance of agriculture*. The other eight activities covered "the use and care of plants", "biodiversity", "conservation of natural resources" and "soil". The emerging code "schoolyard exploration" was present five times, the emerging code "animals in the classroom" once, "identifying plants" four times, and "identifying animals" was found in one activity. In the Earth and Space Science unit, two of the activities were identified as related to "soil" and the emerging code "schoolyard exploration". The emerging code "understanding weather" was also present.

In grade 5, out of the fifty-four activities, there are seventeen related to agriculture. Only four of these were identified by the *a priori* codes and all were related to the emerging code "understanding weather". The four *a priori* codes represented were "soil", "water", "pollution and depletion of natural resources", and "agronomic practices" which was present twice. The emerging code "schoolyard exploration" was found five times.

Grade 6 science includes fifty-six suggested activities, seven of which contain agricultural literacy content. One activity in the Earth and Space Science unit contained the emerging code "understanding weather". In the Life Science unit, two activities had content relating to the code of "biodiversity". Emerging codes were present in four activities in the Life Science unit. Four activities were found to relate to "exploring schoolyards", two to "identifying plants", and two to "identifying animals".

In Figure 5 the number of suggested activities related to agricultural literacy is presented,. Many of the activities related to agricultural literacy were found to include more than one code. For example, in grade 1, the activity "Water, water everywhere", pertains to both production of plant products and agriculture's relationship with the environment but is only counted once in Figure 5. Table 9 shows the number of times that a subject area is present in an activity. It does not include emerging codes.

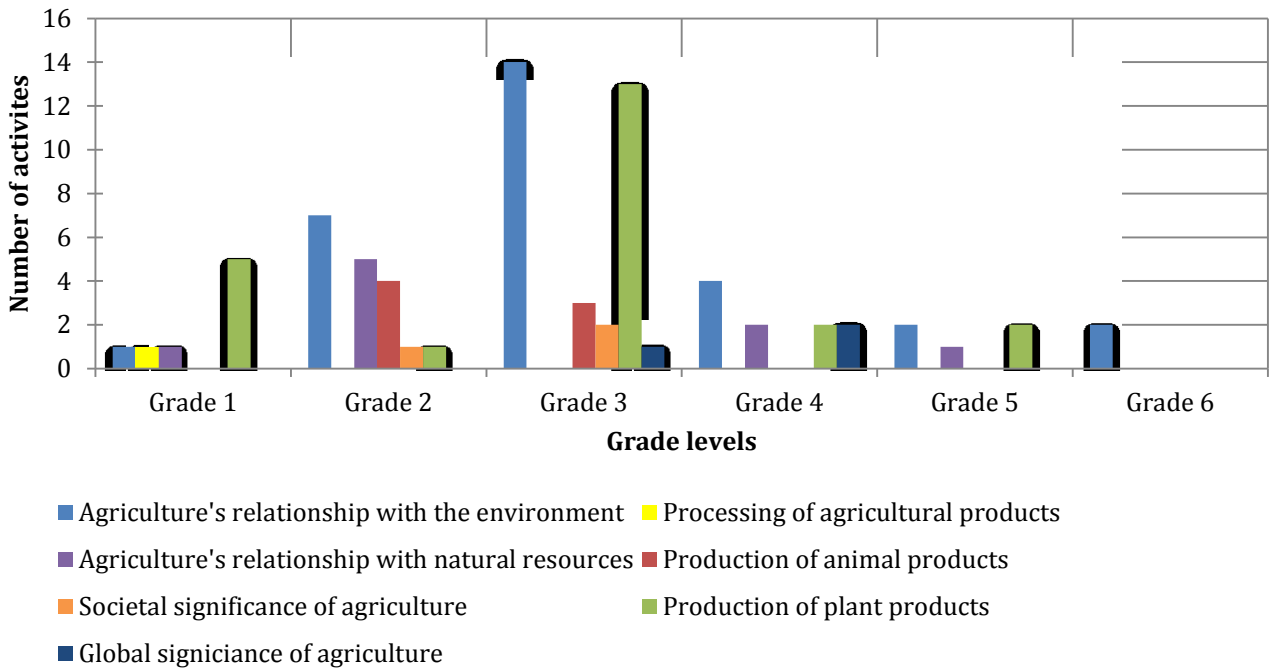


**Figure 6: Agricultural Literacy Related Activities in Nova Scotia Elementary Science Curriculum Sorted by Subject Area and Grade**

One identified agricultural subject area, *public agricultural policies,* was not found to be present in science curriculum at any grade level. Grade one science curriculum was found to covers four of the ten subject areas, with a major emphasis on the production of plant products. Grade 2 covers five of the ten subject areas with an emphasis on *agriculture's relationship with the environment* and *agriculture's relationship with natural resources*. In grade 3, five of the ten subject areas are covered and the emphasis is on *agriculture's relationship with the environment* (particularly "water" and "soil") and the production of plant products. Four of the subject areas were found to be covered in grade four, again with a slight emphasis placed on agriculture's relationship with the environment. In grade five three of the ten subject areas are covered and in grade six only one subject area is covered.

### 3.2 Discussion

The findings suggest that agriculture is not well represented in the elementary school science curriculum guides in Nova Scotia and that student agricultural literacy is therefore not well developed. The presence of agricultural content differs greatly depending on the grade, as do the subject areas addressed. As the students advance in

grade levels, the ideas become more complex and less focused on the basic elements of growing plants and animals.

The curriculum documents for grade 1 science suggest that students should be able to identify animals and plants, have an understanding of weather and understand why it is important for farmers to protect the environment. Experiential learning is referred to in the documentation but the only agricultural activities identified suggest schoolyard exploration rather than working with plants or animals in the classroom.

The grade 2 science curriculum appears to foster environmental awareness concerning pollution and conservation. Understanding weather is also a central theme in this grade. Based on the science curriculum, after graduating from grade two in Nova Scotia, children should have an understanding of the impact that people can have on the environment, but this is not necessarily going to be an understanding of the impact that agriculture can have on the environment. Through the curriculum students will learn the basics of plant and animals care.

The units most obviously related to agricultural literacy emerge in grade 3. Students learn about the functions and importance of soil for growing plants and have many opportunities to grow plants in the classroom. For the first time, the question of where food comes from appears s in the science curriculum guides. Schoolyard exploration and visits to the farm are often suggested as activities.

Building on the basics of growing plants presented in grade 3, grade 4 begins to explain the technologies needed to grow plants in agriculture. Herbicides, pesticides and fertilizers are addressed for the first time. School yard exploration is also a common suggestion in this grade, leading to children making connection with the world around them which is beneficial for increased learning (Mabie & Baker, 1999; Wilson, 1996). Experiential learning is incredibly important for reinforcing the lessons learned in science, especially agricultural literacy, as pointed out by Mabie and Baker (1999). Agriculture is a hands-on subject. This is why it is particularly well suited as a vehicle to teach science in the elementary grades using experiential methods according to the curriculum guides: “It is very important for children to learn through experiences in science. Students can engage in inquiry, problem solving, and decision making only through a hands-on approach to learning” (Department of Education, 2005b, pg. 4).

Weather is the main science topic in grade 5, with an entire unit focused on learning more about weather and the effects of weather on people and the environment around them. The emphasis on weather encourages teachers to take their students outside to better understand the elements. This unit also includes content related to technological advancements in agriculture.

In the final elementary grade the agricultural literacy content is significantly diminished and none of the science topics covered was found to relate directly to agriculture. Although they may enable an understanding of agricultural concepts just the same, if they were to be applied to an agricultural topic.

After grade 3 agricultural technologies and the societal importance of farmers begin to appear as topics in the curriculum guides. But in grades 4 to 6, the science units move away from the physical, biological world in which agriculture plays a significant part and begin to focus on outer space and phenomena such as light and sound. These findings complement the findings of Pense et al. (2005) in which they observed that the aspects of agricultural literacy most understood in grades 4 and 5 were science, technology and the environment and that these grades were least literate in the subjects related to the biological world, food, nutrition and health (Pense et al, 2005, p. 116). The technological aspects of agriculture should be introduced in the higher grades of elementary schools as they are more complex issues that reflect the functioning of the entire agricultural system.

Reading the elementary school science curriculum it may be assumed that children learn the best conditions under which to grow plants indoors and learn that plants outside have different needs. Children are also taught to be aware of the impact that humans have on the environment and natural resources, but this concept is not often linked to agriculture, but rather presented in terms of stewardship, "to be sensitive to the needs of other people, other living things, and the local environment" (Science 1, pg. 16). Even though there is a decrease in agricultural literacy relevant content in grade 4, there are some direct connections made to agriculture, such as the suggested activity "Supporting the Growth of Agriculture". In grade 3, the connections between agriculture and sustainability and therefore society is emphasized in the unit Life Science: Plant Growth and Changes, "Through inquiry then research, students can

explain a variety of uses for plants. This activity reinforces social studies outcomes on sustainability" (Department of Education, 2005b, pg. 30). This also emphasizes that agricultural topics may be found in the social studies curriculum. In grade 5 and 6, these sorts of direct connections are not apparent.

Manifest coding revealed that eight of the ten subject areas suggested for agricultural literacy are present at least once in the elementary school science curriculum guides of Nova Scotia. The two subject areas not addressed at all are: the economic impact of agriculture and the marketing of agricultural products. This may be because the economic impact of agriculture and the marketing of agriculture are not topics that are typically covered in science curriculum. With the exception of a few of the codes ("agriculture's effect on society", "social benefits", "awareness of own nutritional behaviour", "technology and university research", "where food comes from") found in these subject areas, science curriculum rarely considers the societal or global significance of agriculture.

Certain agriculture related codes were found to be covered in every grade, while others were found only once in the entire science curriculum. Many of the codes would be difficult to include in the elementary science curriculum due to the fact that they may be too abstract for children, or fall outside of the traditional discipline of science. Despite its link with science, agricultural literacy is not merely an understanding of the science of agriculture; it requires an interdisciplinary understanding. To be considered agriculturally literate, one must grasp the concept of agriculture in the broadest sense: scientifically, technically and from the social and health perspectives. Thus it is to be expected that curriculum relevant to agricultural literacy may appear across the subject areas in the elementary grades. For example, the economic impact of agriculture falls within the discipline of social studies in primary school (Nova Scotia Department of Education, 2011, pg. 20). The concept of marketing is complex and generally introduced in later grade levels, often not until high school. Some topics related to agriculture, including national agricultural policies, the concept of "supply management" and the use of subsidies to support designated agricultural sectors are extraordinarily complicated concepts, beyond the comprehension of many adults and clearly not appropriate

curriculum content for young children. Not surprisingly they were not found in the Nova Scotia elementary school curriculum materials.

Some topics may be considered too burdensome for children, such as proper water sanitation or disease. The grade 2 science Earth and Space Unit: Air and Water in the Environment includes the statement "Classroom discussions should be limited to the effect of “getting a bad stomach” or having cuts that may get infected or not heal quickly; examples of communities stricken by cholera or other diseases are not appropriate for students of this age” (pg. 60). Complex and distressing topics like this are not addressed in the reviewed curriculum at any time. This does not mean that such topics do not arise in other areas of the curriculum or that they are not introduced in later grades.

The lack of content designed to develop agricultural literacy in the formal elementary school science curriculum guides should not be taken to mean that Nova Scotians are or are not agriculturally literate. To determine the level of agricultural literacy in the broad population would require further study. Nor does it mean that children are not taught agricultural literacy concepts in their formal elementary school education. The curriculum guides are meant to be just what their titles say, guides. Their use depends very much on the individual teacher in the classroom. In the guides the concepts introduced are rarely linked to agriculture and it would be up to teachers to make those connections. Teachers can put as little or as much agricultural content into their lesson plans as they choose, as long as the mandatory curriculum outcomes are achieved.

### 3.3 RECOMMENDATIONS FOR NOVA SCOTIA CURRICULUM AND EDUCATION

Powell et al (2008) found that the best way to increase agricultural literacy through formal education is to create a constructivist education system by incorporating agriculture into the school curricula, creating an agriculturally focused curriculum with infusion of traditional subjects, and incorporating value judgments. Using the activities and outcomes outlined as related to agricultural literacy by this thesis, curriculum developers and other organizations in Nova Scotia can create

suggestions for teachers and schools to make agriculture part of the formal curriculum through agricultural literacy guides and also through revision of the standard curriculum documents.

The review of existing scholarship presented in this thesis and analysis of the presence of content designed to foster agricultural literacy in the elementary grades in Nova Scotia may provide a starting point for a reconsideration of the delivery of agricultural literacy related materials in Nova Scotia schools. Any revision of the curriculum to more effectively develop agricultural literacy should include all possible stakeholders and/or partners in the project. Potential partners who can provide curriculum development expertise include the Department of Education and Green Schools Nova Scotia. Potential partners that have experience in agriculture education outside the formal school curriculum include the 4-H program, the Department of Agriculture, the Farm to Schools programs, and the Evergreen Association. Other potential stakeholders include the Ecology Action Centre, the Nova Scotia Agricultural College and Sustainable Development Education. Green Schools Nova Scotia provides a list of resources for schools interested in agricultural education under the heading "Food" (Green Schools Nova Scotia, 2012). Two of the best resources listed there are "Growing Nova Scotia: A Teachers Guide to Nova Scotia Agriculture" provided by the Nova Scotia Agricultural Awareness Committee and "The School Garden Guide" from the Department of Agriculture.

### 3.4 STUDY LIMITATIONS

The current study looked only at the guide materials for Nova Scotia elementary science curriculum. It provides a snapshot of curriculum materials at a particular time in Nova Scotia. It was not possible during the study period to review the social studies curriculum guides; as the documents were unavailable because they were under revision by the Department of Education. It would also have been beneficial, had there been more time, to assess the textbooks used in the science curriculum.

Education is a complex and fluid concept. How it is received, delivered and interpreted varies from person to person. Incorporating a study of the views, beliefs and

knowledge of students and teachers into this study would have increased its accuracy as a reflection of agricultural literacy development in Nova Scotian schools. Furthermore, more information on the state of agricultural literacy in the children of Nova Scotia would have helped to give context to the findings. A study of the literature suggests more work needs to be done to determine the real current state of agricultural literacy in Nova Scotia and the potential benefits of incorporating agricultural literacy material into the formal elementary school curriculum.

### 3.5 IMPLICATIONS OF STUDY

Even with the fluid and dynamic nature of education, and the limitations in terms of time and scope, this study delivers quantifiable and useful insight into how agricultural literacy is portrayed in the elementary school science curriculum. The findings suggest that in grade 4-6, students are no longer exposed to agriculture in the science classroom. In grades 1-3, though basic agricultural concepts are present, they are often not related back to agriculture.

If the Department of Education and the Department of Agriculture are concerned with the level of agricultural literacy of Nova Scotians, it would be very useful for them to collaborate to ensure future revisions are made to incorporate an emphasis on agriculture or gardens into the noted areas.

### 3.6 RECOMMENDATIONS FOR FURTHER RESEARCH

This study is very much meant to be a preliminary study for implementing more agricultural literacy in the public school curriculum of Nova Scotia. Curriculum revision and development is a lengthy process that requires much consideration and research to ensure that the delivered curriculum is the best it can be. Therefore, to have the best understanding of how to implement agricultural literacy in the curriculum, the following studies are recommended:

- Similar studies assessing agricultural literacy in other subjects, especially social studies and health should also be conducted.

- An assessment of the current agricultural literacy of children in Nova Scotia. A comparative of analysis of Nova Scotia students attending schools with food gardens and students without access to school food gardens.
- An assessment of teachers' attitudes, beliefs, knowledge, and teaching techniques pertaining to agricultural literacy.

### 3.7 CONCLUSION

The elementary school science curriculum guides of Nova Scotia do not cover all the aspects of agricultural literacy necessary to produce informed students. Based on the findings from the curriculum guides, students graduate with a basic understanding of how to grow plants, the technologies available to help farmers and the effects of pollution on the environment. Yet, there is a strong sense in the Nova Scotia education community that agricultural literacy matters. The agricultural literacy of Nova Scotian children could be enhanced with the help of outside organizations and support from the Department of Agriculture and the Department of Education. Ideally all graduates from Nova Scotia schools should be agriculturally literate, and able to become healthy and environmentally conscious citizens.

After generations of increasing disconnect from the sources of our food, society is realizing that agriculture is not a system that can be taken for granted. Food and fiber – the products of agriculture, are integral to how each and every person survives and lives each day. If production and consumption of agricultural products is detrimental to the environment and our health, then the agriculture system is not functioning properly. This study has revealed that agricultural literacy is currently developed only to a limited extent through the elementary science curriculum and that opportunities exist to use the school curriculum to significantly increase awareness.

New curricula and lessons could be created to help create a society that is more conscious of the processes it takes to produce the food that it consumes. Nova Scotia is one of the most forward thinking provinces in regards to sustainable development and its education system is flexible and progressive in welcoming agricultural literacy. It is already part of the movement to educate children about where their food comes from

with programs like Strive for Five, Farm to School, and Evergreen. This is not sufficient to develop full agricultural literacy in every student. By incorporating agricultural literacy more broadly into the curriculum Nova Scotia can solidify this commitment and create a more dynamic, engaging, and relevant experiences for the students of this province.

**APPENDICES**

## APPENDIX 1: Eleven Agricultural Literacy Subject Areas and Their Respective Subareas (Frick et al, 1991, pp. 55-6)

**Agriculture's important relationship with the environment**

- The agriculturist's role in protecting the environment
- The effect of agriculture on the environment
- Opinions and perceptions
- Chemicals
- Positive effects of agriculture on the environment
- Negative effects of agriculture on the environment
- The environment's close relationship with agriculture
- Sustainable Agriculture

**The processing of agricultural products**

- Steps and complexities of processing
- Importance of processing and value added products
- Food safety
- Product development and technology

**Public agricultural policies**

- Government policy impact on agriculture
- The unaware public/consumer
- Government's role and limitations regarding agricultural policy

**Agriculture's important relationship with natural resources**

- Conservation of natural resources
- Sustainable agriculture
- Stewardship of agriculture
- Pollution and depletion of our natural resources
- Codependent relationship between agricultural and natural resources
- Importance of agricultural

**Production of animal products**

- Consumer concerns
- The uses and roles of various animal species
- Biotechnology and genetics
- Animal husbandry

**Societal significance of agriculture**

-Society's lack of awareness
- Agriculture's effect on society
- Rural life
- Social benefits
- Food efficiency

**Production of plant products**

- Greenhouse/gardens
- Use and care of plants
- Agronomic practices

- Biotechnology, biology, and genetics
- Profit
- Society

**Economic impact of agriculture**

- Macroeconomics/microeconomics
- Farm management
- Economic benefits and food costs

**The marketing of agricultural products**

- The distribution system and its importance
- Global distribution and hunger
- Cost of distribution
- Distribution sector employment

**The global significance of agriculture**

- Global food economics
- Global hunger and food distributions
- Technology and university research
- Global politics

## APPENDIX 2: GPI Food and Nutrition Literacy Indicators (Pannozzo, Hayward, K, & Colman, 2008, pg. 107).

-Awareness of own nutritional behaviour
-Understanding of relationship between nutrition, food production and one's own health
-Relationship between nutrition and health of the environment and society
-Impacts of the entire food system on personal, social and environmental health
-Food safety and regulatory standards
-Implications of long-distance transportation
-Action nutritional values of foods
-Implications of agri-business production for local and global farmers and economies
-Treatment of farm animals
-Environmental impact of food production systems

## APPENDIX 3: Final list of agricultural literacy subject areas and codes to use for assessment of Nova Scotia elementary school science curriculum

**Agriculture's Important Role with the Environment**

1) Agriculturist's role in protecting the environment
2) Herbicides
3) Fertilizers
4) Pesticides
5) Water
6 ) Soil
7) Biodiversity
8) Sustainable Agriculture

9) Impact of agriculture on Climate Change

**Processing of agricultural products**

10) Steps and complexities of processing
11) Importance of processing and value added products
12) Food safety and regulatory standards
13) Product development and technology

**Public agricultural policies**

14) Government policy impact on agriculture
15) The unaware public/consumer
16) Government's role and limitations regarding agricultural policy

**Agriculture's Important Relationship with Natural Resources**

17) Conservation of natural resources
18) Pollution and depletion of our natural resources
19) Codependent relationship between agriculture and natural resources

**Production of Animal Products**

20) Antibiotics
21) The uses and role of various species
22) Biotechnology and genetics
23) Animal husbandry
24) Treatment of farm animals
25) Impact of animal production on the environment

**Societal significance of agriculture**

26) Society's lack of awareness
28) Rural life
29) Social benefits
30) Awareness of own nutritional behaviour

**Production of plant products**

31) Greenhouse/gardens
32) Use and care of plants
33) Agronomic practices
34) Biotechnology and genetics

**Economic impact of agriculture**

35) Macroeconomics/microeconomics
36) Farm management
37) Economic benefits and food costs

**The marketing of agricultural products**

38) The distribution system and its importance
39) Global distribution and hunger
40) Cost of distribution
41) Distribution sector employment

**The global significance of agriculture**

42) Global food economics
43) Global hunger and distributions
44) Technology and university research
45) Global politics46) Where food comes from
47) Implications of long-distance transportation

48) Implications of agri-business production for local and global farmers and economies (Frick et al, 1991, pp. 55-6; Pannozzo, Hayward, & Colman, 2008, pg. 107)

## APPENDIX 4: List of all codes that were represented at least once in the elementary school science curriculum guides.

The codes are listed under their subject area. Shown in parentheses beside the subject area is the number of codes found to be present in the document compared to the original number of codes selected.

**Agriculture's Important Role with the Environment** (7/9)
- Agriculturist's role in protecting the environment
- Herbicides
- Fertilizers
- Pesticides
- Water
- Soil
- Biodiversity

**The processing of agricultural products** (3/4)
- Steps and complexities of processing
- Food safety and regulatory standards
- Product development and technology

**Public agricultural policies** (1/3)
- The government's role and limitations regarding agricultural policy

**Agriculture's important relationship with natural resources** (3/3)
- Conservation of natural resources
- Pollution and depletion of our natural resources
- Codependent relationship between agricultural and natural resources

**Production of animal products** (2/6)
- The uses and role of various animal species
- Treatment of farm animals

**Societal significance of agriculture** (3/5)
- Agriculture's effect on society
- Social Benefits
- Awareness of own nutritional behaviour

**Production of plant products** (3/4)
- Greenhouse/gardens
- Use and care of plants
- Agronomic practices

**The Global Significance of Agriculture** (2/7)
- Technology and university research
- Where food comes from

Total (24/48)

## APPENDIX 5: Codes not present in the elementary school science curriculum guides.

Codes are listed under their subject area.

**Agriculture's Important Relationship with the Environment**
- Sustainable Agriculture
- Impact of Agriculture on Climate Change

**Processing of Agricultural Products**
- Importance of processing and value added products

**Public Agricultural Policies**
- Government policy impact on the industry
- The unaware public/consumer

**Production of Animal Products**
- Antibiotics
- Biotechnology and Genetics
- Animal Husbandry
- Impact of animal production on the environment

**Societal Significance of Agriculture**
- Society's lack of awareness
- Social benefits

**Production of Plant Products**
- Biotechnology and Genetics

**The Economic Impact of Agriculture**
- Macroeconomics/microeconomics
- Farm management
- Economic benefits and food costs

**The Marketing of Agricultural Products**
- The distribution system and its importance
- Global distribution and hunger
- Cost of distribution
- Distribution sector employment

**The Global Significance of Agriculture**
- Global food economics
- Global hunger and food distributions
- Global politics
- Implications of long-distance transportation
- Implications of agri-business production for farmers and economies

## APPENDIX 6: List of learning outcomes related to agricultural literacy in the Nova Scotia Elementary School Science Curriculum

This list includes the outcomes coded in emerging codes.

**Grade 1:**

**Life Science: Needs and Characteristics of Living Things**

Characteristics of Living Things

- Identify, conduct, measure, and record observations about animals and plants using appropriate terminology (201-5, 100-8, 203-2)

- listen and respond to another student's description of an animals or plant (203-4)

Needs of Living Things

- recognize that humans and other living things depend on their environment and identify personal action that can contribute to a healthy environment (103-2)

**Earth and Space Science: Daily and Seasonal Changes**

Introduction to Cycles: Daily/Seasonal Changes in Heat and Light

- identify and record the days of the week, the names of the seasons, and predict the type of weather for various seasons (200-3, 203-2)

Daily Changes in Living Things

- investigate and describe, using a variety of formats, how daily changes affect the characteristics, behaviours, and locations of living things (200-1, 201-4, 201-5)

Seasonal Changes in Living Things

- investigate and describe human preparations for seasonal changes (103-4)

**Grade 2:**

**Physical Science: Liquids and Solids**

Mixing Liquids and Solids to Make New and Useful Materials

- describe and demonstrate ways we use our knowledge of solids and liquids to maintain a clean and health environment (102-8)

**Earth and Space Science: Air and Water in the Environment**

Materials and Moisture

- describe the effects of weather and ways to protect things under different weather conditions (103-7)

Protecting our water sources.

- identify examples of water in the environment and describe ways that water is obtained, distributed, and used (200-3, 200-4, 200-1, 203-3)
- identify the importance of clean water for humans, and suggest ways they could conserve water (103-7)

**Life Science: Animal Growth and Changes**

Investigating the Needs and Life Cycle of an Organism

- select and use materials to observe an organism's life cycle and ask questions about the organism's needs and changes in growth (200-1, 200-4)
- propose suggestions for meeting the needs of the organism being investigated and draw conclusions about its growth patterns or stages based on the observations (202-7)

Comparing Life Cycles of Familiar Animals

- describe features of natural and human-made environments that support the health and growth of some familiar animals (102-7)

Human Growth and Development

- identify the basic food groups and describe actions and decisions that support and healthy lifestyle (100-16)

**Grade 3:**

**Life Science: Plant Growth and Changes**

Investigating Germination and Growing Conditions for Plants

- place seeds in groups according to one of more attributes (202-3)
- question and records relevant observations and measurements while investigating various growing conditions for plants (200-1, 201-5, 202-4)
- identify and describe parts of plants and their general function (100-28)
- identify, investigate, and suggest explanations for life needs of plants and describe how plants are affected by conditions in which they grow (100-29)

The Life Cycle of a Plant

- observe, describe, and measure, using written language, pictures, and charts, changes that occur through the life cycle of a flowering plant (201-3. 203-3, 202-4)
- observe and describe changes that occur through the life cycles of a flowering plant (100-30)

Uses for Plants

- describe and respond to ways in which plants are important to living things and the environment and how the supply of useful plants is replenished (102-12, 201-13, 203-5)

**Earth and Space Science: Exploring Soils**

Investigating Soils Composition

- ask questions and make predictions that lead to exploration and investigation about the composition of soil (200-1, 200-3)
- investigate, describe, and record a variety of soils and their components using words and diagrams (100-36, 100-37, 201-3, 201-5)

Water Absorption of Soils

- describe, predict, and compare the absorption of water by different types of soil (100-38, 200-3)
- communicate procedures and results of investigations related to water absorption of soils, using drawings, demonstrations, and/or written and oral description (203-3)

Moving water and soil

- observe and describe the effects of moving water on different types of soil (100-39)

Interactions of living things and soil

- investigate and describe how living things affect and are affected by soils (100-35)

**Grade 4:**

**Life Science: Habitats**

Structural Features of Plants That Enable Them to Survive in Their Habitat

- describe how scientists' knowledge of plant growth has led to agricultural and technological innovations and the impact on local and regional habitat issues (105-1, 206-4, 108-1)

Food Chains

- predict how the removal of a plant or animal population affects the rest of the community and relate habitat loss to the endangerment or extinction of plants and animals (301-1, 301-2)

**Earth and Space Science: Rocks, Minerals and Erosion**

Erosion and Weathering

- describe ways in which soil is formed from rocks and demonstrate and describe the effects of wind, water, and ice on the landscape (301-4, 301-5)

**Grade 5**

**Earth and Space Science: Weather**

Measuring and Describing Weather

- identify and use weather-related folklore to predict weather (105-2)
- using correct names of weather instruments, construct and use instruments to record temperature, wind speed, wind direction, and precipitation (104-7, 204-8, 205-4, 205-10, 205-7, 300-13)
- identify, classify, and compare clouds (1-4-4, 206-1)
- using a variety of sources, gather information to describe the key features of weather systems and identify weather-related technological innovations and products that have been developed by cultures in response to weather conditions (107-14, 205-8, 302-11)

Sun's Energy Reaching the Earth

- relate the transfer of energy from the sun to weather and discuss the sun's impact on soil and water (206-5, 303-21)

Properties of Air

- describe situations demonstrating that air takes up space, has mass and expands when heated (300-14)

Movement of Air and Water

- relate the constant circulation of water on Earth to processes of evaporation, condensation, and precipitation (301-13)

Environmental Issues

- describe how studies of the depletion of the ozone layer, global warming, and the increase in acid rain have led to new innovations and stricter regulations on emissions from cars, factories, and other pollution technologies (106-4)

**Life Science: Meeting Basic Needs and Maintaining a Healthy Body**

Maintaining a Healthy Body

- describe nutritional and other requirements for maintaining a healthy body and evaluate the usefulness of different information sources in answering questions about health and diet (206-4, 302-9)

**APPENDIX 7: A review of each specific outcome section of Nova Scotia elementary school science curriculum.**

| *Codes* | Grade1 | Grade2 | Grade3 | Grade4 | Grade5 | Grade6 |
|---|---|---|---|---|---|---|
| ***Total agricultural literacy outcomes per level*** | ***5*** | ***9*** | ***22*** | ***3*** | ***9*** | ***2*** |
| ***Agriculture's relationship with the environment*** | **1** | **2** | **8** | **2** | **2** | **0** |
| Agriculturist's role in protecting the environment | 1 | | 1 | | | |
| Herbicides | | | | | | |
| Fertilizers | | | | | | |
| Pesticides | | | | | | |
| Water | | 2 | 3 | | 2 | |
| Soil | | | 7 | 1 | 1 | |
| Biodiversity | | | | 1 | | |
| Sustainable agriculture | | | | | | |
| Impact of agriculture on climate change | | | | | | |
| ***The processing of agricultural products*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Steps and complexities of processing | | | | | | |
| Importance of processing and value added products | | | | | | |
| Food safety and regulatory standards | | | | | | |
| Product development and technology | | | | | | |
| ***Public agricultural policies*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Government policy impact on the industry | | | | | | |
| The unaware public/consumer | | | | | | |
| The government's role and limitations regarding agricultural policy | | | | | | |
| ***Agriculture's important relationship with natural resources*** | **0** | **2** | **0** | **0** | **1** | **0** |
| Conservation of natural resources | | 1 | | | | |
| Pollution and depletion of our natural resources | | 1 | | | 1 | |
| Codependent relationship between agricultural and natural resources | | | | | | |
| ***Production of animal products*** | **0** | **3** | **0** | **0** | **0** | **0** |
| Antibiotics | | | | | | |
| The uses and role of various animal species | | | | | | |
| Biotechnology and genetics | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Animal husbandry | | | | | | |
| Treatment of farm animals | | 3 | | | | |
| Impact of animal production on the environment | | | | | | |
| ***Societal significance of agriculture*** | **0** | **1** | **0** | **0** | **1** | **0** |
| Society's lack of awareness | | | | | | |
| Agriculture's effect on society | | | | | | |
| Rural life | | | | | | |
| Social benefits | | | | | | |
| Awareness of own nutritional behaviour | | 1 | | | 1 | |
| ***Production of plant products*** | **0** | **0** | **8** | **0** | **0** | **0** |
| Greenhouse/gardens | | | 2 | | | |
| Use and care of plants | | | 4 | | | |
| Agronomic practices | | | 4 | | | |
| Biotechnology and genetics | | | | | | |
| ***Economic impact of agriculture*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Macroeconomics/microeconomics | | | | | | |
| Farm management | | | | | | |
| Economic benefits and food costs | | | | | | |
| ***The marketing of agricultural products*** | **0** | **0** | **0** | **0** | **0** | **0** |
| The distribution system and its importance | | | | | | |
| Global distribution and hunger | | | | | | |
| Cost of distribution | | | | | | |
| Distribution sector employment | | | | | | |
| ***The global significance of agriculture*** | **0** | **0** | **0** | **1** | **1** | **0** |
| Global food economics | | | | | | |
| Global hunger and food distributions | | | | | | |
| Technology and university research | | | | 1 | 1 | |
| Global politics | | | | | | |
| Where food comes from | | | | | | |
| Implications of long-distance transportation | | | | | | |
| Implications of agri-business production for farmers and economies | | | | | | |
| ***Emerging Codes*** | **4** | **1** | **0** | **1** | **7** | **2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Understanding weather | 2 | 1 | | 1 | 7 | |
| Impact of agriculture on the environment | | | | | | |
| Identifying animals | 2 | | | | | |
| Identifying plants | 2 | | | | | 2 |
| Visits to the farm | | | | | | |
| Schoolyard exploration | | | | | | |
| Student-tended gardens | | | | | | |
| Animals in the classroom | | | | | | |

**Each subject area is shaded in grey and the codes of each subject area are represented directly underneath. The numbers in the row of each subject area represent the total number of agricultural literacy outcomes in that grade level pertaining to that subject area. The numbers within the row of each code, represent the total number of outcomes containing that specific code. Some outcomes contain more than one code, and if both codes are from the same subject area, they are counted as only one outcome under that subject area.**

## APPENDIX 8: A review of the Strategies and Tasks sections of the Nova Scotia elementary school science curriculum

| Codes | Grade1 | Grade2 | Grade3 | Grade4 | Grade5 | Grade6 |
|---|---|---|---|---|---|---|
| ***Total number of AL related strategies and tasks*** | ***34*** | ***64*** | ***109*** | ***41*** | ***48*** | ***16*** |
| ***Agriculture's relationship with the environment*** | **0** | **15** | **69** | **10** | **13** | **2** |
| Agriculturist's role in protecting the environment | | | 5 | | | |
| Herbicides | | | | 1 | | |
| Fertilizers | | | | 2 | | |
| Pesticides | | | | 1 | | |
| Water | | 15 | 12 | 2 | 10 | 2 |
| Soil | | | 52 | 1 | 3 | |
| Biodiversity | | | | 3 | | |
| Sustainable agriculture | | | | | | |
| Impact of agriculture on climate change | | | | | | |
| ***The processing of agricultural products*** | **0** | **0** | **2** | **0** | **0** | **3** |
| Steps and complexities of processing | | | 2 | | | |
| Importance of processing and value added products | | | | | | |
| Food safety and regulatory standards | | | | | | |
| Product development and technology | | | | | | 3 |
| ***Public agricultural policies*** | **0** | **0** | **0** | **1** | **0** | **0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Government policy impact on the industry | | | | | | |
| The unaware public/consumer | | | | | | |
| The government's role and limitations regarding agricultural policy | | | | 1 | | |
| ***Agriculture's relationship with natural resources*** | **2** | **10** | **5** | **8** | **1** | **0** |
| Conservation of natural resources | 1 | 6 | | 2 | | |
| Pollution and depletion of our natural resources | 1 | 4 | 2 | 6 | 1 | |
| Codependent relationship between agricultural and natural resources | | | 3 | | | |
| ***Production of animal products*** | **5** | **8** | **0** | **0** | **0** | **0** |
| Antibiotics | | | | | | |
| The uses and role of various animal species | | | | | | |
| Biotechnology and genetics | | | | | | |
| Animal husbandry | | | | | | |
| Treatment of farm animals | 5 | 8 | | | | |
| Impact of animal production on the environment | | | | | | |
| ***Societal significance of agriculture*** | **0** | **4** | **4** | **0** | **2** | **0** |
| Society's lack of awareness | | | | | | |
| Agriculture's effect on society | | | 3 | | | |
| Rural life | | | | | | |
| Social benefits | | | 1 | | | |
| Awareness of own nutritional behaviour | | 4 | | | 2 | |
| ***Production of plant products*** | **7** | **0** | **25** | **5** | **0** | **1** |
| Greenhouse/gardens | 2 | | 9 | 2 | | |
| Use and care of plants | 5 | | 16 | 2 | | |
| Agronomic practices | | | | 3 | | 1 |
| Biotechnology and genetics | | | | | | |
| ***Economic impact of agriculture*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Macroeconomics/microeconomics | | | | | | |
| Farm management | | | | | | |
| Economic benefits and food costs | | | | | | |
| ***The marketing of agricultural products*** | **0** | **0** | **0** | **0** | **0** | **0** |
| The distribution system and its importance | | | | | | |
| Global distribution and hunger | | | | | | |
| Cost of distribution | | | | | | |
| Distribution sector employment | | | | | | |
| ***The global significance of agriculture*** | **1** | **0** | **0** | **2** | **0** | **0** |
| Global food economics | | | | | | |
| Global hunger and food distributions | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Technology and university research | 1 | | | 2 | | |
| Global politics | | | | | | |
| Where food comes from | | | | | | |
| Implications of long-distance transportation | | | | | | |
| Implications of agri-business production for farmers and economies | | | | | | |
| **Emerging Codes** | **19** | **27** | **4** | **15** | **35** | **10** |
| Understanding weather | 1 | 10 | 2 | 5 | 35 | 2 |
| Effects of weather on the agriculture | 1 | 6 | | 1 | | |
| Impact of agriculture on the environment | | | | | | |
| Identifying animals | 4 | 2 | | | | 3 |
| Identifying plants | 4 | 1 | | | | 4 |
| Visits to the farm | 2 | 1 | | | | |
| Schoolyard exploration | 2 | 4 | 1 | 6 | | 1 |
| Animals in the classroom | 2 | 3 | | 1 | | |
| Plants in the classroom | 3 | | 1 | 2 | | |

**Each subject area is shaded in grey and the codes of each subject area are represented directly underneath. The numbers in the row of each subject area represent the total number of times that a code in that subject area occurred in that grade. The numbers within the row of each code, represent the total number of outcome containing that specific code.**

**Appendix 9: Activities related to agricultural literacy present in the elementary school science curriculum of Nova Scotia**

| Unit | Activity | Agricultural Literacy Code(s) |
|---|---|---|
| **Grade 1** | | |
| Physical Science: Materials, Objects and our Senses | Activity 12 | Food safety and regulatory standards |
| Life Science: Needs and Characteristics of Living Things | Activity 23 | Exploring schoolyards |
| | Activity 24 | Use and care of plants |
| | Activity 25 | Use and care of plants |
| | Activity 26 | Identifying plants and identifying animals |
| | Activity 30 | Use and care of plants |
| | Activity 31 | Use and care of plants, and pollution and depletion of our natural resources |
| | Activity 32 | Use and care of plants |
| Earth and Space Science Unit | Activity 45 | Schoolyard exploration |
| | Activity 46 | Schoolyard exploration |
| | Activity 49 | Schoolyard exploration |
| **Grade 2** | | |
| Physical Science: Liquids and Solids | Activity 12 | Understanding weather |
| | Activity 25 | Understanding weather |
| | Activity 24 | Water, and pollution and depletion of our resources |
| | Activity 26 | Understanding weather |
| Earth and Space Science: Air and Water in the Environment | Activity 27 | Understanding weather, and schoolyard exploration |
| | Activity 28 | Schoolyard exploration |
| | Activity 29 | Care of animals, and understanding weather |
| | Activity 30 | Water |
| | Activity 32 | Water, soil, understanding weather, and plants in the classroom |
| | Activity 33 | Understanding weather |
| | Activity 34 | Water |
| | Activity 39 | Understanding weather, and |

| | | |
|---|---|---|
| | | schoolyard exploration |
| | Activity 40 | Water, and pollution and depletion of natural resources |
| | Activity 41 | Water, and pollution and depletion of natural resources |
| | Activity 42 | Water, and conservation of natural resources |
| | Activity 43 | Water, pollution and depletion of natural resources, and use and care of plants |
| | Activity 44 | Water, pollution and depletion of natural resources, and use and care of plants |
| Life Science: Animal Growth and Changes | Activity 45 | Treatment of farm animals, and animals in the classroom |
| | Activity 46 | Animals in the classroom, and schoolyard exploration |
| | Activity 48 | Animals in the classroom |
| | Activity 49 | Animals in the classroom |
| | Activity 50 | Animals in the classroom |
| | Activity 52 | Treatment of farm animals |
| | Activity 53 | Treatment of farm animals, and animals in the classroom |
| | Activity 54 | Agriculturist's role in protecting the environment, and schoolyard exploration |
| | Activity 55 | Agriculturist's role in protecting the environment |
| | Activity 59 | Awareness of nutritional behaviour |
| **Grade 3** | | |
| Life Science: Plant and Growth Changes | Activity 1 | Identifying plants |
| | Activity 2 | Soil, use and care of plants, |

| | | |
|---|---|---|
| | | plants in the classroom |
| | Activity 3 | Use and care of plants, and plants in the classroom |
| | Activity 4 | Use and care of plants, schoolyard exploration, and plants in the classroom |
| | Activity 5 | Use and care of plants, and identifying animals |
| | Activity 6 | Soil, plant and care, and plants in the classroom |
| | Activity 7 | Use and care of plants, and identifying plants, and plants in the classroom |
| | Activity 8 | Use and care of plants, and identifying plants |
| | Activity 9 | Use and care of plants, and agriculture's effect on society, and where food comes from |
| | Activity 10 | Visits to the farm and schoolyard exploration |
| | Activity 11 | Use and care of plants |
| Earth and Space Science: Exploring Soils *each activity 12-24 codes for soil | Activity 13 | Schoolyard exploration |
| | Activity 15 | Water |
| | Activity 18 | Water, and use and care of plants, and understanding weather |
| | Activity 20 | Use and care of plants, and understanding weather |
| | Activity 22 | Visits to the farm, and schoolyard exploration |
| | Activity 23 | Use and care of plants, and understanding weather |
| **Grade 4** | | |
| Life Sciences: Habitats | Activity 2 | Use and care of plants |
| | Activity 4 | Biodiversity, identifying animals, and plants |

| | | |
|---|---|---|
| | Activity 5 | Schoolyard exploration |
| | Activity 6 | Schoolyard exploration, and identifying plants |
| | Activity 8 | Schoolyard exploration |
| | Activity 9 | Schoolyard exploration |
| | Activity 10 | Schoolyard exploration |
| | Activity 11 | Animals in the classroom |
| | Activity 15 | Use and care of plants, and identifying plants |
| | Activity 16 | Agriculturist's role in protecting the environment, herbicides, pesticides, water, pollution and depletion of natural resources, technology and university research |
| | Activity 17 | Conservation of natural resources, technology and university research, impact of agriculture on the environment |
| | Activity 20 | Biodiversity |
| Earth and Space Science: Rocks, Minerals and Erosion | Activity 76 | Soil, understanding weather, and schoolyard exploration |
| | Activity 77 | Soil, and schoolyard exploration |
| **Grade 5** | | |
| Earth and Space Science: Weather * all activities 1-16 code for understanding weather | Activity 4 | Schoolyard exploration |
| | Activity 5 | Schoolyard exploration |
| | Activity 6 | Schoolyard exploration |
| | Activity 11 | Soil, agronomic practices, and schoolyard exploration |
| | Activity 12 | Water, and schoolyard exploration |
| | Activity 13 | Agronomic practices |
| | Activity 16 | Pollution and depletion of natural resources |
| **Grade 6** | | |

| | | |
|---|---|---|
| Earth and Space Science: Space | Activity 31 | Understanding weather |
| Life Science: Diversity of Life | Activity 43 | Exploring schoolyards, and identifying plants |
| | Activity 44 | Identifying plants |
| | Activity 45 | Identifying animals |
| | Activity 47 | Identifying animals |
| | Activity 53 | Biodiversity |
| | Activity 55 | Biodiversity |

## APPENDIX 10: A review of the Suggested Activities in the Nova Scotia elementary school science curriculum.

| Codes | Grade1 | Grade2 | Grade3 | Grade4 | Grade5 | Grade6 |
|---|---|---|---|---|---|---|
| ***Agricultural literacy related activities*** | ***6*** | ***16*** | ***22*** | ***8*** | ***5*** | ***2*** |
| ***Agriculture's relationship with the environment*** | **1** | **8** | **14** | **4** | **2** | **2** |
| Agriculturalist's role in protecting the environment | | 2 | | 1 | | |
| Herbicides | | | | 1 | | |
| Fertilizers | | | | | | |
| Pesticides | | | | 1 | | |
| Water | 1 | 6 | 6 | 1 | 1 | |
| Soil | | 2 | 14 | 2 | 1 | |
| Biodiversity | | | | 2 | | 2 |
| Sustainable agriculture | | | | | | |
| Impact of agriculture on Climate Change | | | | | | |
| ***The processing of agricultural products*** | **1** | **0** | **0** | **0** | **0** | **0** |
| Steps and complexities of processing | | | | | | |
| Importance of processing and value added products | | | | | | |
| Food safety and regulatory standards | 1 | | | | | |
| Product development and technology | | | | | | |
| ***Public agricultural policies*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Government policy impact on the industry | | | | | | |
| The unaware public/consumer | | | | | | |
| The government's role and limitations regarding agricultural policy | | | | | | |
| ***Agriculture's relationship with natural resources*** | **1** | **5** | **0** | **2** | **1** | **0** |
| Conservation of natural resources | | 2 | | 1 | | |
| Pollution and depletion of our natural resources | 1 | 6 | | 1 | 1 | |
| Codependent relationship between agricultural and natural resources | | | | 1 | | |
| ***Production of animal products*** | **0** | **4** | **3** | **0** | **0** | **0** |
| Antibiotics | | | | | | |
| The uses and role of various animal species | | | 1 | | | |
| Biotechnology and genetics | | | | | | |
| Animal husbandry | | | | | | |
| Treatment of farm animals | | 4 | 2 | | | |
| Impact of animal production on the environment | | | | | | |
| ***Societal significance of agriculture*** | **0** | **1** | **2** | **0** | **0** | **0** |
| Society's lack of awareness | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Agriculture's effect on society | | | 2 | | | |
| Rural life | | | | | | |
| Social benefits | | | | | | |
| Awareness of own nutritional behaviour | | 1 | | | | |
| ***Production of plant products*** | **5** | **1** | **13** | **2** | **2** | **0** |
| Greenhouse/gardens | | | | | | |
| Use and care of plants | 5 | 1 | 13 | 2 | | |
| Agronomic practices | | | | | 2 | |
| Biotechnology and genetics | | | | | | |
| ***Economic impact of agriculture*** | **0** | **0** | **0** | **0** | **0** | **0** |
| Macroeconomics/microeconomics | | | | | | |
| Farm management | | | | | | |
| Economic benefits and food costs | | | | | | |
| ***The marketing of agricultural products*** | **0** | **0** | **0** | **0** | **0** | **0** |
| The distribution system and its importance | | | | | | |
| Global distribution and hunger | | | | | | |
| Cost of distribution | | | | | | |
| Distribution sector employment | | | | | | |
| ***The global significance of agriculture*** | **0** | **0** | **1** | **2** | **0** | **0** |
| Global food economics | | | | | | |
| Global hunger and food distributions | | | | | | |
| Technology and university research | | | | 2 | | |
| Global politics | | | | | | |
| Where food comes from | | | 1 | | | |
| Implications of long-distance transportation | | | | | | |
| Implications of agri-business production for farmers and economies | | | | | | |

**Each subject area is shaded in grey and the codes of each subject area are represented directly underneath. The numbers in the row of each subject area represent the total number of agricultural literacy activities in that grade level pertaining to that subject area. The numbers within the row of each code, represent the total number of activities containing that specific code. Some activities contain more than one code, and if both codes are from the same subject area, they are counted as only one activity under that subject area.**

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