UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Healthy & Sustainable Snacks

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Abstract

The objective of this project was to determine the most sustainable egg products available for UBC Food Services to source. Extensive literature review was required to conduct triple bottom line (TBL) assessments of UBC's current whole shell egg, liquid egg, and heat-and-serve omelet products. TBL assessments were also performed on the egg products recommended to UBC in order to meet sustainable purchasing goals. TBL assessments were conducted taking social, environmental and economic indicators into consideration. Key informant interviews were conducted with egg producers, suppliers and distributors to gain a more thorough understanding of the current egg production practices in BC. Visits to egg breaking and grading facilities, as well as a conventional, a free-run, and a free-range farm allowed for the verification of the researched claims regarding animal welfare practices related to each egg designation. Regarding whole shell eggs, the TBL assessment revealed that free-run eggs provide enhanced animal welfare conditions to laying hens; however, they have a higher environmental impact and are slightly more expensive when compared to the current free-run eggs currently purchased by UBC Food Services. Based on these TBL assessment results, it was recommended that UBC Food Services source free-range eggs to replace the free-run eggs. It was also recommended that BC Certified Organic eggs be sourced by UBC for their higher end/more progressive outlets because the TBL indicated that this certification ensures a high animal welfare standard. Regarding liquid eggs, it was recommended that UBC source free-run products instead of their current conventional products. The TBL assessment indicated that these products offer a similar environmental impact, but that free-run eggs have higher animal welfare standards. Additionally, because the difference in price is not significant, it is realistic that UBC make this change. Finally, regarding heat-and-serve omelet products, it was recommended that UBC phase

out the use of their current conventional product. This recommendation resulted from the fact that all heat-and-serve omelet products on the market are produced from conventional eggs. Furthermore, since the closest production facility is in Manitoba, it is impossible to source the product from a closer distance.

I. Introduction

Eggs have long been recognized for their nutritive value, as they are potent protein sources and one of only a few foods that serve as natural sources of vitamin D (IEC, 2012). The food commodity's widespread popularity may also be attributed to its considerable versatility of use; the egg may serve as the focal point of a dish, or may function as a dietary ingredient in baked goods, pastas, and a variety of processed food products. In 2006, the FAO estimated global egg production to total 61.1 billion dozen eggs, with the world's largest producer being China, producing 25.3 billion dozen annually. The European Union, the United States, India, Japan and the Russian Federation followed, producing 19.1 billion dozen collectively (Agriculture and Agri-Food Canada, 2013). In Canada, roughly 500 million dozen eggs are produced each year (Egg Farmers of Canada, n.d.). As stated by Mench, Sumner and Rosen-Molina (2011), the majority of eggs produced internationally are of the conventional variety, with greater than 95% of commercial laying hens residing in conventional, or battery, cages. Battery-cage systems allow for enhanced efficiency of production, by way of automation of feeding, watering and egg collection, as well as improved control of environmental factors (Mench et al., 2011). This, in turn, better allows egg producers to meet consumer demands.

In recent years, changes in laying hen production systems toward non-cage systems including free-run, free-range, and organic systems have been observed the world-over, driven largely by consumer concern for animal welfare (Mench et al., 2010). In North America,

consumer demand for cage-free eggs has led to the adoption of cage-free purchasing policies by a multitude of universities, restaurants, and municipalities (Humane Society International/Canada, 2012). In the province of British Columbia, with 12% of layer hens raised in cage-free systems, the demand for 'Specialty Eggs' is evident and growing (BC Egg Marketing Board, n.d.; Humane Society International/Canada, 2012). In fact, British Columbia has been identified among those leading the way towards more sustainable egg production (J. Dick, Golden Valley Foods, personal communication, March 27, 2013).

The University of British Columbia, in all aspects of university infrastructure, education, and research, strives to embody social, economic and ecological sustainability (The University of British Columbia, n.d.a). By way of a multitude of campus initiatives, including UBC's Climate Action Plan (CAP) and the institution's Sustainable Purchasing Guide, it is hoped that UBC may exemplify and advance sustainability on campus and beyond (The University of British Columbia, n.d.a). The UBC Food System Project (UBCFSP), another campus initiative, aims to improve the sustainability of the school's food system and, ultimately, support the movement towards sustainability of broader food systems (The University of British Columbia, n.d.b). As part of the UBCFSP, we have been tasked with assessing the sustainability of current institutional egg procurement practices in order to determine whether the egg products currently sourced by the university are the most sustainable products available, and, if not, to identify the best available alternatives. Through modeling of best practices for sustainable food systems, including the procurement of the most socially, economically and environmentally sustainable egg products available, the university may support the movement towards sustainability of larger food systems, including the Canadian, North American and global systems, and perhaps influence change in broader sustainability practices. We therefore hope to answer the question:

Which liquid, heat-and-serve, and whole shell egg products are the most ecologically, socially and economically sustainable, and thus, should be sourced by UBC Food Services?

In 2011, UBCFSP partners and student participants sought to identify those principles of sustainability upon which a utopian food system should be based (UBC Food System Project, 2011). These principles, as presented by the UBCFSP's *Vision Statement for a Sustainable Food System*, are, for the most part, realistic as well as appropriate to the goals of this project, in the view of all members of our group. We argue there exists only a small number of principles in the vision statement that should perhaps be altered due to non-feasibility. The second principle listed, which states that "animals raised for food are treated humanely and are integrated into ecologically friendly farming models," may not be possible for the egg industry at present. This is due to the fact that commercial egg production is not integrated into mixed models of farming, and thus, the production of eggs through fully environmentally sustainable farming models seems unlikely. Another issue identified by our group, relating to the principles outlined, is that it appears unfeasible for both the third principle, claiming that in a utopian food system "food is locally grown, produced and processed in support of local people, infrastructure and economies," and the fourth principle, which states that "food is culturally and ethnically appropriate, affordable, safe, nutritious and minimally processed," to be realized simultaneously. Our group found it difficult to envision how food may be both locally grown as well as culturally and ethnically appropriate. This is especially true in Vancouver, a city characterized by much cultural diversity, and the inability to grow many of the foods significant to said cultures.

As students in the Faculty of Land and Food Systems (LFS), issues of food system sustainability as well as human and environmental health have been, and continue to be, emphasized by way of course materials and teachings. Having been tasked with performing triple

bottom line and life cycle assessments on several egg products of the whole-shell, liquid, and heat-and-serve omelet varieties, our group found that we approached the project believing conventional systems to be the least sustainable of all egg production types. Furthermore, we found ourselves weighing more heavily the indicators of social and environmental sustainability, whilst assessing the various egg products and certification types. This is due to the fact that we have been primed to place greater value on ethical and ecological concerns, rather than economic factors through our membership in the Faculty of LFS, and the UBC community as a whole.

II. Methods

For our UBCFSP scenario, we were tasked with conducting both life cycle assessments (LCA) and triple bottom line (TBL) assessments on all of (1) whole shell egg products, (2) heat-and-serve omelets, and (3) liquid egg products of various certification types such that recommendations might be made as to which egg certification, or certifications, should be procured by UBC Food Services. In order to see the project's intended outcomes realized it was essential that we determine what is expected of both LCA and TBL assessments, such that we might understand how to go about conducting them. It was also necessary for our group to outline all relevant egg certifications, including the designations of organic, free-range, free-run (also called cage-free), conventional, and BC SPCA, in order to consider the advantages and disadvantages of each. A review of pertinent literature served as the means by which we were able to establish TBL and LCA methodology, as well as review all appropriate egg certifications. By way of literature review, we were also able to identify several key reports, including The UBC Sustainable Purchasing Guide, UBC's Climate Action Plan, as well as the UBC Food System Project's Vision Statement for a Sustainable UBC Food System, which served to further inform our TBL methodology. Relevant materials were found by searching a variety of search

terms pertaining to the TBL approach, LCA, and the appropriate egg certifications, including ("Triple Bottom Line Assessment") AND ("eggs" OR "egg production"), ("Life Cycle Assessment") AND ("eggs" OR "egg production"), and ("eggs") AND ("certification") in Google Scholar and UBC Library's Summon. The BC Ministry of Agriculture, Egg Farmers of Canada, the BC Egg Marketing Board, and the International Egg Commission websites were also searched. Additionally, relevant materials pertaining to the UBCFSP as well as other campus sustainability initiatives were obtained on the LFS 450 Vista course page.

TBL assessments report on the sustainability of a product or service, taking into consideration pertinent economical, social and ecological indicators (ACT Government, 2012). By way of our literature review, we were able to identify relevant indicators to consider whilst conducting our TBL assessments. These include energy, water, and feed efficiency, distance from UBC, greenhouse gas emissions (GHG), pesticide use, land use, aspects of animal welfare, and cost per unit. Life Cycle Assessments, conducted for each identified egg product, inform the environmental impacts of a product, taking into consideration resource use as well as any environmental burdens associated with production of the food commodity (Leinonen, Williams, Wiseman, Guy, & Kyriazakis, 2012). As such, the LCA performed for each identified product functions as an ecological indicator of sustainability, and a component of the product's TBL assessment. TBL assessments and LCA were facilitated by way of literature review as well as through email, telephone, and in-person key informant interviews conducted with Vicki Wakefield, various egg product distributors and producers, and a representative from the BC Egg Marketing Board.

A meeting with Vicki Wakefield, Purchasing Manager of UBC's Student Housing and Hospitality Services and key stakeholder in the project, on February 5th, 2013, provided us with

information relating to the current egg procurement practices as well as the goals of UBC's Student Housing and Hospitality Services regarding future procurement. Vicki was also able to supply our group with the contact information of various representatives for several egg product distributors, including Gordon Food Service, Vanderpol's Eggs and Centennial Food Service. It was suggested we contact these individuals to learn of the various egg products available for purchase in the volumes required by UBC Student Housing and Hospitality Services, as well as the differences in price existing among products.

Email communication with Monty Cramp, a representative from Vanderpol's Eggs, Sanju Lal, a representative from Gordon Food Service (GFS), and Toni Lui, a representative from Centennial Food Service, was initiated in mid-February, 2013. Questions pertaining to the egg product types supplied by the various distributors, as well as relative product prices, were posed. Our group also inquired as to whether these distributors would be able to facilitate farm-visits, such that a better understanding of each identified egg designation may be achieved and the validity of designation claims assessed. By way of this electronic communication, we learned the availability and affordability of identified egg products, as well as the locations from which current egg products are sourced. This information further informed the TBL assessments. Through email communication, it was further arranged for Henry Meerstra and Monty Cramp, two representatives from Vanderpol's Eggs, to visit UBC such that questions posed in the emails might be further discussed.

A meeting with Henry Meerstra and Monty Cramp, conducted on February 27, 2013, provided our group with insight into the availability, pricing, and sourcing of the various liquid egg product types in the province of British Columbia. We also made arrangements to visit farms, egg grading and egg breaking facilities. On the 27th of March, 2013, our group traveled to

Abbotsford, BC, to tour Vanderpol's Eggs breaking facility, Golden Valley's grading facility, and three farms: one free-range, one free-run and one conventional. Henry Meerstra, who accompanied us as we toured the various sites, facilitated these visits.

Communication through email was initiated on February 18, 2013. A telephone interview was conducted on March 19, 2013 with Randy Friesen, a representative from the BC Egg Marketing Board, who provided information relating to the management of BC Specialty Egg products. More specifically, free-range and free-run products, and future plans for third-part certification, were discussed. This information further contributed to an understanding of the various egg certification types. The BC Egg Marketing Board was initially contacted using the email provided on their webpage, and subsequent communication was with Randy Friesen directly.

Evaluation of our progress over the duration of the project was maintained through regular communication with our community partner, Vicki Wakefield, as well as LFS 450 course instructor Sophia Baker-French and teaching assistant Josh Edward. Additionally, our ability to meet project deadlines, as outlined by our proposed timeline, allowed for continuous evaluation of progress. Evaluation of project outcomes will be carried out the week of April 8, by way of a final meeting with project partner Vicki Wakefield. At this time, project outcomes will be assessed, and it will be established whether expectations for the project have been met.

III. Egg Certifications

a. Results:

Conventional Eggs:

Egg certifications exist to certify that eggs were produced in production systems alternative to the conventional caged production system. Conventional eggs may not necessarily

bound by any production certifications. Conventional eggs are laid by hens housed in battery cages, and inputs are not certified organic. Benefits to the conventional battery cage system include protection from predators, weather extremes, and negative social effects of group living (CARC, 2003).

BC Specialty

BC Specialty eggs, both Free-Run and Free-Range, adhere to guidelines set out by the Canadian Agri-Foods Research Council in the *Recommended Code of Practice for the Care and Handling of Pullets, Layers, and Spent Fowl: Poultry – Layers*. Auditing is run internally by the BC Egg Marketing Board (R. Friesen, Manager, Production and Research, BC Egg Marketing Board, personal communication, March 19, 2013).

BC Specialty Free-Run Eggs

Laying hens in Free-Run systems are usually housed in large indoor barns; battery cages are not permitted. Hens may have access to litter for dust bathing and scratching, and/or nests and perches (Vancouver Humane Society, n.d.). Animal welfare benefits of the Free-Run system include protection from predators and extreme weather conditions, greater freedom of movement and the ability to express natural behaviours (such as perching and nesting) (CARC, 2003). Litter materials must be free of toxic substances, and litter should be replaced if it becomes too dusty or wet. Enough perches should be provided such that aggression between hens is minimized, and nests should be easy to access (CARC, 2003). Space requirements depend on flooring type and age and variety of hen. More space is required for litter floors, and less for wire or slatted floors. Space requirements are outlined in Table 1.

Table 1. Free-Run Floor Space requirements (From CARC, 2003, p.12)

Age (weeks)	Maximum body weight (g)	Minimum floor space(cm2)	
		All litter	All wire/slats
0 - 6	400 (0.88 lb.)	500 (78 in.^{2})	250 (39 in.^{2})

6 -18/19	1320 (2.90 lb.)	1400 (217 in.²)	700 (109 in.²)
adult[1]	1700 (3.74 lb.)	1700 (264 in.²)	850 (132 in.²)
adult[2]	1900 (4.18 lb.)	1900 (295 in.²)	950 (147 in.²)

[1]typical white-egg layer
[2]typical brown-egg layer

BC Specialty Free-Range Eggs:

Laying hens in Free-Range systems are usually housed in large indoor barns and must have access to pasture. Animal welfare benefits of the Free-Range system include greater freedom of movement, expression of natural behaviours and access to outdoors and sunlight (CARC, 2003). Outdoor rangeland should be well-drained and free of poisonous plants, unsafe water-sources, and dangerous chemicals. Gutters should be installed on barns to avoid the creation of mud-holes in pasture areas. Birds should have access to shelter from sun and weather. Fences must be installed along the perimeter of the farm in order to protect the flock from land-roaming predators (CARC, 2003).

BC SPCA Certified

The British Columbia Society for the Prevention of Cruelty to Animals (BC SPCA) runs a third-party certification program that certifies that animals were raised according to high animal welfare standards. The BC SPCA inspects farms annually and randomly. Certification must be renewed every year. Cages are prohibited on BC SPCA certified farms, and housing systems may be either free-run or free-range (BC SPCA, 2009).

Permitted stocking densities vary depending on floor type. Maximum density permitted is 5.28 hens/m^2 with bedding and 9.09 hens/m^2 on partially slatted floors (BC SPCA, 2009). Birds must have access to litter (depth of at least 5 cm), and litter must be monitored daily. Birds must have access to a dry area for dust-bathing and resting (BC SPCA, 2009). 15 cm of perch space must be provided per bird. Some perches must be at least 30 cm above the ground. There should be one nest box per 5 hens or 1 m^2 per 120 hens if nest boxes are communal (BC SPCA, 2009).

Light must be provided at least 8 hours/day. Moreover, feed must be available at all times and cannot contain animal or mammal proteins. Fresh water must be available at all times. There should be adequate space at feeders and drinkers for every bird. Space required depends on bird age and feeder/drinker type (BC SPCA, 2009).

Hormones are prohibited for growth, and are only allowed for disease treatment. Antibiotics are prohibited from feed and are permitted only for the purpose of veterinary treatment. Beak-trimming is acceptable when necessary (ie. if there is a threat to welfare due to cannibalism on the farm), (BC SPCA, 2009).

Air quality must be regulated; maximum allowances are as follows: air quality limits: Ammonia: 20 ppm; Carbon Dioxide: 5000 ppm; Dust: 10 mg/m^3 (BC SPCA, 2009).

BC SPCA Certified Free-Range

BC SCPA Free-Range farms, along with all of the above requirements, must also adhere to the following rules. Access to pasture must be provided for at least 6h/day, 180 days of the year. In addition, pop-holes must be evenly distributed along the barn. The outdoor area must be well-drained and provide foraging opportunities as well as access to shelter (BC SPCA, 2009).

Certified Organic (Free-Range)

Certified Organic eggs are produced on farms that adhere to Certified Organic Associations of British Columbia (COABC) Standards. Certified Organic farms are subject to third-party annual and random inspections.

Battery cages are prohibited in certified organic systems. Hens must have free access to pasture (dependent on weather, access can be restricted in case of emergencies). Maximum allowable stocking density is 6 hens/ m^2 indoors, and 4 hens/ m^2 outdoors. Nest-boxes, perches, and nesting/bedding materials for dust-bathing, foraging, and scratching are required. There

should be at least 18cm of perch space provided for each hen and litter must be kept dry (Standards Council of Canada, 2011).

Natural light must be provided indoors during daytime hours. Producers are prohibited from adding antibiotics to feed. Hormones are prohibited except for veterinary purposes. If the hormone used is not listed in the Organic Standards, or if antibiotics are given, the animal will lose its organic status. Feed must be certified organic. No mammal or avian by-products are allowed in the feed. There must be enough feeders and drinkers provided for all birds (Standards Council of Canada, 2011). Beak-trimming is only allowed when absolutely necessary (ie. If the hen exhibits problem behaviours) (Standards Council of Canada, 2011).

b. Discussion

Some uncertainty exists as to how often and to what extent auditing of BC Specialty eggs is managed. Randy Friesen of the BC Egg Marketing Board stated that BC Specialty Eggs must adhere to the Recommended Best Practices set out by the CARC, whose guidelines are otherwise voluntary (R. Friesen, Manager, Production and Research, BC Egg Marketing Board, personal communication, March 19, 2013). However, the code uses the language "must" and "should", and it is unclear as to whether BC Specialty Eggs are required only to follow where "must" is used, or if they are obliged to follow guidelines using the language "should" (CARC, 2003). The code is currently under review by the National Farm Animal Care Council (NFACC), and thus guidelines will likely be updated in the near future (National Farm Animal Care Council, 2012). Additionally, information retrieved on our farm visits suggests that farmers voluntarily follow American or International best practice guidelines, and not Canadian guidelines.

The BC Egg Marketing Board has contracted a third-party certification agency which will be certifying free-run and free-range producers, through the grading station. Currently, there are

plans to launch this program in May 2013. After the implementation of this program, BC would be the only province in Canada to have a third-party certifying its free-run and free-range eggs (R. Friesen, Manager, Production and Research, BC Egg Marketing Board, personal communication, March 19, 2013).

The results of our review of existing egg certifications suggest that, in terms of animal welfare especially, the highest standards are achieved through BC SPCA and Certified Organic certifications, followed by BC Specialty Free-Run and BC Specialty Free-Range.

Although we were unable to visit BC SPCA and Certified Organic egg production facilities, we were able to tour one conventional, one BC Specialty Free-Run, and one BC Specialty Free-Range egg farm. We observed that though animal welfare is to some degree dictated by the certification type, it is also very dependent on the management practices and care of each individual farmer. What we saw was not what we expected to see based on researched information of common welfare issues in each housing system. For example, at the conventional farm, we did not observe any issues associated with cannibalism or foot lesions often associated with a cage system. Though the chickens could not express natural behaviours (wing flapping, walking, roosting, etc.), health was clearly of utmost concern to the producer. We would like to note that though housing type affects the hens' affective states and ability to express natural behaviour, their health is nonetheless dependent on management practices. It is possible that the management practices at farms with BC SPCA and Organic certifications are more closely monitored by the third-party certifying bodies to achieve a level of uniformity or health, but as we were unable to visit these facilities we are unable to report on validity of this statement.

IV. Triple Bottom Line Assessments

a. Assumptions

In order to conduct both a triple bottom line and life cycle assessment of each egg product, certain assumptions were required. Regarding the life cycle assessments it is assumed that once eggs have reached the grading and processing facilities, their treatment is the same. That being said, we will assume that the environmental impact of these stages in the egg's life cycle to be the same when comparing the current and recommended products. Furthermore, the environmental impact of waste disposal will be assumed to be the same for these products and will therefore not be given a numerical value in the life cycle assessment. Packaging will be treated in the same fashion, as there are no differences in packaging for bulk orders of the products that have been analyzed.

Regarding the social impact of the products, we assumed the freedom and ability to express natural behaviour are important for laying hen welfare. Many problems related to laying hen welfare are reduced when they are able to perform their natural behaviours (Fraser, 2008). For example, the laying hens will experience less frustration when there is a nest box available. The ability to perform the behaviours they are motivated to perform allows hens to experience better affective states. Laying hens that can perform natural behaviours also exhibit less abnormal behaviours that are commonly observed in hens in conventional cage systems (Fraser, 2008). By allowing hens to live a more natural life in a more natural environment, the welfare of the hens may be improved.

b. Results

Table 2. Triple bottom line assessment for whole shell egg products

		Current = free run/cage free	**Recommendation = free-range**	**Recommendation = organic**

Social	Basic Health and Function	Protection from predators and parasites[1]	-Direct contact with outdoors and potential to ingest organisms from the soil[2] -Hens may be subjected to extreme weather conditions[2] -Greater risk of predation and being infected by disease from wild animals[4]	*See free-range
	Affective States	-Lower incidences of cannibalism[3] -Dominant hens in some strains defend the feeder which results in hens with a low rank to have less access to food[4]	-Cannibalism and feather picking are possible, particularly in large flocks[4]	*See free-range
	Natural Living	Space allows for exploratory behaviour, locomotion, and body-maintenance[4] -Some perches[3]	-Exposure to natural sunlight and outdoors -Opportunities to dust bathe and sunbathe[4] -More perches -Foraging behaviours possible[5] -Complex environments allow hens to make choices and have more control[4] -Large behaviour diversity and freedom to perform natural behaviours[4] -Enrichment possible with vegetation and shelters[4]	*See free-range
Environmental	Energy (MJ/kg eggs produced)	18.14[6]	13.1 – 15.4[7]	13.1 – 21.12[8]
	Water Footprint (L/kg eggs	Information not available	2543[9]	Information not available

	produced)			
	GHG emissions (kg CO_2e/kg eggs produced)	2.86[6]	2.38 – 6.18[10]	2.78 - 4.04[8]
	Distance from distributor to UBC(km)	2306	75.5	75.5
	Land Use (ha/1000 kg eggs produced)	0.42[6]	0.51[6]	1.69[6]
	Feed Consumption (g/hen/day)	125[6]	130[6]	131[6]
	Pesticide Use (dose/ha/kg eggs produced)	2.20[6]	2.33[6]	0.09[6]
Economic	Cost per Unit	$3.35/dozen[11]	-More expensive/dozen than free-run, but less expensive/dozen than organic [11]	$6.90/dozen [11]

[1]BC SPCA (2009)
[2]Holt et al. (2011)
[3]J. Minderhoud, Producer, personal communication, March 27, 2013
[4] Lay et al., (2011)
[5]Blaine Regehr, Producer, Maple Hill Farms, personal communication, March 27, 2013
[6]Leinonen et al., (2012)
[7]Range from Weidemann and McGahan (2011) and Williams et al. (2006)
[8]Range from Dekker et al. (2008), and Leinonen et al. (2012)
[9]Weidemann and McGahan, (2011)
[10]Range from EWG (2011), Mollenhorst et al. (2006), and Williams et al. (2006)
[11] Personal communication, James Dick, Producer Rep., Golden Valley Foods, 27 March, 2013

Table 3. Triple bottom line assessment for liquid egg products

		Current Product = Conventional	**Recommendation = Cage-free/Free-run**
Social	Basic Health and Function	-Cage layer fatigue occurs in caged hens -Caged hens have increased susceptibility to osteoporosis	*See free-run in Table 2

		because of lack of exercise -Bone strength poorer in caged hens -Rubbing against cage walls and other hens when moving in the cages causes plumage damage and decreases thermoregulatory capacity[1] -Conventional cage systems are older (>20 years old) and have buildup of manure and dust [2]	
	Affective States	-Repetitive pacing in cages before oviposition as a sign of frustration[1] -Less fear observed in hens[3]	*See free-run in Table 2
	Natural Living	-Environments with restrictive space do not allow hens to perform natural behaviours which is negative in terms of welfare -Dust bathing occurs even though no dust baths where hens perform the behaviour on wired floor and do not complete the sequence of dust-bathing[1]	*See free-run in Table 2
Environmental	Energy (MJ/kg eggs produced)	10.7 – 18.7[4]	18.14[5]
	Water Footprint (L/kg eggs produced)	2186[6]	Information not available
	GHG emissions (kg CO_2e/kg eggs produced)	1.86 - 2.5[7]	2.86[5]
	Distance from distributor to UBC(km)	2306	75.5
	Land Use (ha/1000 kg eggs produced)	0.40[5]	0.42[5]
	Feed Consumption (g/hen/day)	115[5]	125[5]
	Pesticide Use (dose/ha/kg eggs produced)	2.07[5]	2.20[5]
Economic	Cost per Unit	$3.33/kg	$3.65/kg[8,9]

[1]Lay et al., (2011)
[2]Holt et al. (2011)
[3] D. Hiebert, Producer, personal communication, March 27, 2013)
[4]Range from Weidemann and McGahan (2011) and Williams et al., (2006)

[5]Leinonen et al., (2012)
[6]Weidemann and McGahan, (2011)
[7]Range from Verge et al. (2009), and EWG (2011)
[8]H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, February 27, 2013
[9]Note: This price is an estimate for study purposes only, based on UBC purchasing through Centennial Foods.

c. Discussion

The liquid egg products that are currently purchased by UBC are made with conventionally produced eggs that are sourced from GFS in Manitoba. A life cycle assessment demonstrated that caged systems are the most efficient production system with respect to energy use per kg of eggs. This is mainly due to the superior production efficiency for caged hens (Weidemann and McGahan, 2011). Dan Hiebert, a conventional producer, explained that he is able to capture 97% of the eggs that are laid in his facility (Personal communication, March 27, 2013). On-farm GHG emissions from caged operations come mainly from feed production, on farm energy use, nitrous oxide from poultry litter, and fuel combustion. Post-farm emissions are dominated by transport, processing, and waste disposal (EWG, 2011). Table 2 gives the values for each indicator of the life cycle assessment of conventional eggs.

The life cycle assessment allowed us to determine that the environmental impact of free-run eggs is similar to that of conventional eggs (Table 2). This is due mainly to the fact that the hens remain confined to the barn. The values for the environmental indicators are not exactly the same, however, due to the fact that production efficiency in this system is lower than that of conventional eggs. It is possible that eggs can be lost as ground eggs when they are not laid in the nests, or when hens may step on them and break them (J. Minderhoud, Producer, personal communication, March 27, 2013).

The most important environmental difference between conventional liquid egg products and free-run liquid egg products is that the current supplier, GFS, is unable to provide free-run liquid eggs (Personal communication, S. Lal, Sales Account Coordinator, Gordon Food Service,

March 14, 2013). It is possible, however, to source this product from Vanderpol's Eggs, a local distributor located in Abbotsford, British Columbia. That being said it is possible to source free-run eggs from a distance of 75.5 km from UBC, as oppose to the current conventional product which is sourced from 2306 km from UBC. Finally, the price difference between the liquid egg products that are currently being purchased by UBC and free-run liquid egg products is relatively small (Table 3).

UBC currently purchases free-run whole shell egg products from GFS in Manitoba. As previously explained, this is a production system with a similar environmental impact to a conventional production system, however with better animal welfare conditions for the laying hens. Both free-range and organic production systems have a higher environmental impact than free-run eggs (Table 3). Because hens have access to the outdoors in both free-range and organic systems, they will consume a greater amount of grain. This has an impact on GHG emissions and water consumption, as these two indicators are both related to feed production and consumption (Weidemann and McGahan, 2011).

While gaps in our research did not allow us to fully assess the differences in environmental impact of free-range and organic eggs, organic systems have higher animal welfare standards. As previously explained this is due to the fact that organic systems follow stricter guidelines and are third party certified, while free-range systems are not. The main environmental difference between free-range and organic eggs is the fact that hens raised in an organic system are fed organic feed. Table 2 states that pesticide use in an organic system is significantly lower than what is used in a free-range system. Furthermore, the land required for both systems is significantly different. This is directly related to the amount of land required to produce organic feed versus conventional feed. Another important difference between the two

systems is that organic eggs are significantly more expensive than free-range eggs. James Dick, a producer representative for Golden Valley Foods, informed us that organic eggs will cost approximately $6.90/dozen (personal communication, March 27, 2013). While we were not able to obtain exact pricing information for free-range eggs, we were told by both James Dick and Henry Meerstra that free-range eggs are more expensive than free-run eggs, but less expensive than organic eggs (personal communication, March 27, 2013).

Speaking with a sales representative from Vanderpol's Eggs, we were informed that both free-range and organic whole shell eggs could be sourced from their facility in Abbotsford. This distributor supplies almost exclusively BC eggs, with the vast majority being produced in the Fraser Valley (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, February 27, 2013).

The current heat-and-serve omelet products that are purchased by UBC are made with conventionally produced eggs. We became aware that conventional eggs are the only available option for this product, and that there are no other options currently on the market. Furthermore, it was made known to us that this is likely to remain the case for the foreseeable future, as volumes of specialty eggs are not high enough to support the production of these types of products (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, February 27, 2013). Two of the varieties of omelet purchased by UBC (the plain and cheddar cheese varieties), are produced and sourced from GFS in Manitoba. The third, the Western Omelet, is produced in the US (S. Lal, Sales Account Coordinator, Gordon Food Service, personal communication, March 14, 2013). Henry Meerstra further informed us that there are no processing facilities closer than Manitoba that produce these omelets.

We have not included a triple bottom line assessment for the heat-and serve omelet products. Because there is no possibility of moving away from conventionally produced eggs for this product, and because it is not possible to source it from anywhere closer than Manitoba, we feel it is reasonable to refer to the section on conventional eggs that appears in Table 3 for social and environmental values associated with the production of this product.

V. Stakeholder Recommendations:

a. Whole-Shell Eggs

We recommend that by September 2013, UBC Food Services replace their current (free-run) whole-shell egg products with BC Specialty Free-Range whole-shell eggs.

As discussed above, free-range conditions provide enhanced welfare to laying hens in terms of their ability to express natural behaviour such as sun-bathing, dust-bathing, foraging, and scratching. Though BC Specialty Free-Range whole-shell eggs are more expensive than free-run alternatives, they are less expensive than Certified Organic eggs.

We recommend that UBC Food Services source BC Certified Organic (free-range) whole-shell eggs for their higher-end and/or more progressive food outlets.

These may include but are not limited to outlets such as the Point Grill and Place Vanier Dining Hall. The Point Grill strives to use sustainable ingredients whenever possible (The Point Grill, n.d.). The Place Vanier Dining Hall, known as a leader in sustainability on campus, may be opened to offering BC Certified Organic eggs as an option for patrons. As noted above, BC Certified Organic eggs ensure that a high animal welfare standard is achieved. Because the language in the *Organic Production Systems: General Principles and Management Standards* clearly defines acceptable practices, we have concluded that BC Certified Organic (free-range)

ensures a higher welfare standard relative to BC Specialty Free-Run and Free-Range eggs, as the BC Specialty Program is currently managed (Standards Council of Canada, 2011). Since BC Certified Organic eggs are considerably more expensive than BC Specialty Free-Range and Free-Run, it is not feasible from an economic sustainability standpoint that we recommend UBC Food Services source BC Certified Organic whole shell eggs exclusively.

b. Liquid Eggs

We recommend that by September 2013, UBC Food Services replace their current liquid egg products with BC Specialty Free-Run liquid egg products.

As outlined above, BC Specialty Free-Run standards ensure enhanced welfare for laying hens relative to conventional systems, especially with regards to the ability and freedom of hens to express natural behaviour. A LCA determined that the environmental impact of free-run eggs is similar to that of conventional eggs. Additionally, BC Specialty Free-Run liquid eggs are market-ready and cost approximately $0.30/kg more than conventional liquid whole eggs (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, March 27, 2013). This is considerably more affordable than BC Specialty Free-Range liquid whole eggs, which cost approximately $3.40/kg more than conventional liquid whole eggs (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, March 27, 2013).

c. Heat-and-Serve Omelets

Short-term goal:

We recommend that UBC Food Services discontinue the use of the Western Omelet (#85126, from GFS).

The Western Omelet is currently produced in the US, using US eggs. The Cheddar Cheese and Plain Omelets that UBC Food Services currently purchases from GFS are produced

in Winnipeg using Manitoba eggs (S. Lal, Multi Unit Sales Account Coordinator, Gordon Food Service, personal communication, March 14, 2013). Because the UBC Sustainable Campus Food Guide explicitly prioritizes sourcing Canadian products over international products, we believe that it is in-line with the vision of the UBC Food System stakeholders to source Manitoba omelets over US omelets (Baker-French, S., 2013).

Long-term goal:

We recommend that UBC Food Services replace heat-and-serve omelets with liquid egg and other products to phase out the use of heat-and-serve omelets.

There is no processing facility that produces this product in Canada closer than the one located in Winnipeg, Manitoba, 2306 km from UBC (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, March 27, 2013; J. Dick, Producer Representative, Golden Valley Foods Ltd., personal communication, March 27, 2013). However, liquid egg products produced and processed in the Fraser Valley and greater British Columbia are available and market-ready (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, March 27, 2013). The UBC Sustainable Campus Food Guide and the UBCFSP Visions For A Utopian Food System both state that food in a sustainable food system is locally grown, produced, and processed (UBC Food System Project, 2011; Baker-French, S., 2013). The UBC Sustainable Food Guide states that purchasing local food can support local farmers and processors (Baker-French, S., 2013). Since we have referred to these documents to guide our recommendations, we believe that our recommendation to replace heat-and-serve omelets with liquid egg products is in-line with UBC's vision of sustainability.

We feel that we have insufficient knowledge as to the inner-workings of UBC Food Services' purchasing and food preparation practices to provide adequate timelines, but hope that UBC Food Services will implement this recommendation as soon as possible at their discretion.

d. Sourcing

We recommend that UBC Food Services source their egg products from a supplier that offers local (BC) products.

GFS, which currently supplies all egg products to UBC Food Services, does not offer liquid eggs or heat-and-serve omelets that are produced or processed in BC. Vanderpol's Eggs produces liquid egg products from eggs sourced locally, with the majority from the Fraser Valley and at some from Vancouver Island, the Okanagan, and/or Alberta if Fraser Valley eggs are in short supply (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, February 27, 2013). Centennial Food Service is a Canadian supplier that offers Vanderpol's products (H. Meerstra, Sales Manager, Vanderpol's Eggs, personal communication, February 27, 2013). (See Appendix 1 for contact information).

The UBC Sustainable Purchasing Guide cites stimulating the local economy by supporting local suppliers as a benefit of sustainable purchasing (UBC Supply Management & the Campus Sustainability Office, 2010). Sourcing from within BC provides support for the local economy, local farmers, local suppliers, and the progressive egg production standards of our province. It also reduces the environmental impact of egg sourcing because the products travel a shorter distance to reach UBC. We believe that sourcing from a supplier that offers locally produced and processed egg products would help achieve UBC's sustainable purchasing goals.

We feel that our understanding of contracts with suppliers is too limited to provide an adequate timeline, but hope that UBC Food Services will implement this recommendation as soon as possible at their discretion.

VI. Scenario Evaluation

Throughout the duration of the project, regular communication with our project partner, Vicki Wakefield, as well as the LFS 450 teaching team, allowed for continual evaluation of our progress. It remains to be seen whether we were successful in our efforts since evaluation of the project outcomes have yet to occur. The outcome evaluation will be carried out by way of periodic interviews with our project partner, to occur at the project's completion, at 6 months post-project, and at 1 year following the project's end. In the week of April 8, 2013, our group intends to meet with Vicki to discuss project findings as well as determine the feasibility of recommended actions. For a 6 months post-project, we intend to follow-up with our project partner, by way of an in-person, over-the-phone, or electronic interview, such that it may be seen whether the recommendations made have been put into practice; that is, we seek to determine whether any changes in campus egg procurement practices towards more sustainable practices have occurred. Finally, a year from now, a third follow-up interview with Vicki will be conducted in order to discuss the success (or failure) of these new and more sustainable egg procurement practices in order to determine whether our contributions have been meaningful.

VII. Group Reflection

As is often the case for community-based learning, we experienced successes and challenges throughout the duration of the project. To begin with our successes; first, as members of UBC's LFS 450, and in partnership with those involved in the UBCFSP, we were given the

opportunity to contribute to improve the sustainability of the UBC food system by carrying out of one of several UBCFSP projects. It is hoped that through our efforts, egg procurement practices at UBC will be revised and the most sustainable egg products possible will become those chosen by the institution. Another success is having been able to make contact with a multitude of individuals working in the egg industry, including representatives from various egg production facilities, as well as egg breaking and egg grading operations. The contacts made were extremely supportive of our efforts, and facilitated our first hand observation of various egg production practices. The egg industry is known to be rather private, so our ability to make such contacts is significant.

With respect to challenges faced, our group identified three primary obstacles. First, access to information pertaining to economic, social and environmental indicators of the sustainability of egg production practices was found to be limited. Second, whilst conducting our TBL assessments, our group found it challenging to weigh the various indicators of sustainability. As students in the Faculty of Land and Food Systems, we found ourselves placing the greatest weight on social considerations, followed by environmental, and subsequently economic, indicators. Thus, our recommendations relating to the most sustainable egg products to be sourced certainly reflect our own personal value assumptions. Finally, as we conducted a literature review as well as key informant interviews, it is possible that both funding bias and reporting bias may have impacted our project findings.

Taken as a whole, our involvement with the UBCFSP has allowed us to contribute to improving the sustainability of campus egg procurement practices, thereby improving the sustainability of the UBC food system as a whole. Through our experiences a great deal of

knowledge relating to the production and procurement of egg products, as well as a better understanding of food system sustainability and all contributing factors has been achieved.

VIII. Recommendations for Future LFS Students & Teaching Team

We recommend that the teaching team facilitate contact with egg distributors so students are better equipped to schedule and arrange farm and facility visits in a timely fashion.

Our group found it challenging to organize farm visits. We were very fortunate to meet Henry Meerstra, Sales Manager of Vanderpol's Eggs, who graciously arranged tours for us. We believe it would greatly benefit students to be given contact information of industry representatives they can contact in order to arrange similar tours in the future. See Appendix 1 for contact information.

We recommend that the scope of future LFS 450 UBSFSP be narrowed such that more meaningful outcomes can be achieved.

Our group felt overwhelmed with the tasks we were assigned. We felt we were not able to provide thorough a TBL assessment and LCA due to time constraints, lack of relevant literature, lack of expertise (we could only conduct these assessments through literature review), and needing to meet multiple outcomes. We feel that results from future projects may be more thorough if their scope is more specific.

We recommend that a future LFS 450 Project Scenario be designed to determine the economic feasibility and consumer demand and acceptance of Certified Organic eggs at UBC.

We recommended that UBC Food Services source Certified Organic whole-shell eggs at some of their more progressive and/or higher-end food outlets because Certified Organic eggs

are considerably more expensive than BC Specialty Free-Run and BC Specialty Free-Range whole-shell eggs. We believe that a feasibility analysis that would take into account the campus community's willingness to pay for Certified Organic eggs could help UBC Food Services implement our recommendation and indicate if such a change is possible campus-wide.

We recommend that a future LFS 450 Project scenario be designed to reassess the BC Specialty Egg certification program and standards relative to BC Certified Organic eggs and BC SPCA Certified eggs.

Although our group examined BC Specialty Free-Run and BC Specialty Free-Range designations, the BC Specialty Egg certification process will soon change. A third-party certification system is to be launched in May 2013 (R. Friesen, Manager, Production and Research, BC Egg Marketing Board, personal communication, March 19, 2013). Additionally, the *Recommended Code of Practice for the Care and Handling of Pullets, Layers, and Spent Fowl: Poultry – Layers*, to which BC Specialty Free-Run and Free-Range adhere, are currently under review by the National Farm Animal Care Council (NFACC), and may soon be updated (NFACC, 2012).

We recommend that a future LFS 450 Project Scenario be designed to re-assess the differences between BC Certified Organic eggs and conventionally produced eggs, specifically focussing on the environmental impacts of organic and conventional production practices.

Our recommendation to source Certified Organic eggs wherever possible is based principally on animal welfare concerns, as we encountered gaps in our LCA literature review and we were unable to completely compare the potential environmental impacts of conventionally-produced feed versus organically-produced feed (for example soil, air, and water pollution by

agro-chemicals, the effect of agro-chemical use on the evolution of pests and noxious weed species, or the effects of the use of GMOs). We believe that it is important to know whether or not Certified Organic eggs are more environmentally sound than their conventional counterparts.

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Media Release

UBC Food System Project

April 2013

Triple Bottom Line and Life Cycle Assessments for Eggs

The UBC Food System Project (UBCFSP) aims to make the UBC campus food system more sustainable and support the movement towards sustainability of broader food systems. As part of the UBCFSP, our group was asked to determine whether UBC currently sources the most sustainable egg products and, if not, to identify the best available alternatives. Through literature review, visits to production facilities, and interviews with industry professionals, our group conducted both triple bottom line and life cycle assessments of three different egg product types;

whole shell eggs, liquid eggs, and heat-and-serve omelets. We assessed the sustainability of current and alternative egg products based on ecological, social and environmental indicators, so recommendations relating to the most sustainable products available could be made. In touring the various facilities, we were provided with the opportunity to observe first-hand egg production practices in BC, including layer hen housing systems at conventional, free-run, and free-range farms, and egg grading and breaking processes. Through our participation in the project, and the UBCFSP generally, group members were able to contribute to the bettering of food system sustainability, both on campus and beyond.

"*The sustainability of egg products are determined by ecological, social and environmental factors."*

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