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Promoting healthy communities includes securing a safe and adequate food supply. The organic portion of our garbage is part of our food ecosystem production, and should be returned to the soil as compost to supply nutrients and organic matter. This paper outlines why our food production is an integral part of a healthy community, and why adding compost to our soil is so important for maintaining soil health and productivity.

In summary:

- Sustainable food production is one of the primary components for healthy communities
- Maintaining and increasing soil organic matter content is integral to sustainable food production.
- Soil organic matter is increased by adding compost
- Compost can be produced from organic waste – it closes the recycling loop

A healthy community can be defined on various levels, from a household, up to our global community. For the purpose of this paper, our “community” is British Columbia, with an emphasis on a 400 km radius of the major population centers. There is an incredible diversity of food products grown in British Columbia.

There are concerns about our environment and our food supply. The safety of our food supply has come into question regarding additives and pesticides in imported foods. We are encouraged to reduce our carbon footprint by reducing our greenhouse gas emissions. We are encouraged to purchase local foods. We are facing decisions to ban cosmetic pesticides and chemicals in our urban environments. We are concerned about our economy and finding meaningful jobs for people. In this paper, we will outline how composting our organic matter addresses these environmental and food supply concerns.

Our communities are making important decisions on the future of the organic waste that is now going to landfill. Options include various scenarios of energy recovery through burning, energy recovery using bioreactor landfills, and source separation including composting. Source separation and composting is the best option for the future of our organic waste when we consider a sustainable and healthy future for us and our children.

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## ***What is a Healthy Community?***

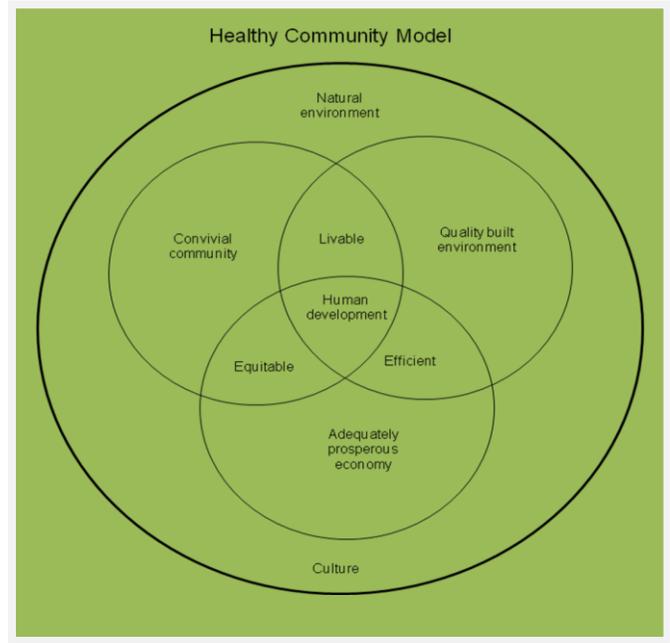
A healthy community exists at multiple levels. A community may include a household, a neighbourhood, a town or city, or a region. In the context of this paper, we assume that our healthy community includes the province of British Columbia. The principles in this paper can be applied at any of the various levels. Our definition of a healthy community must also include our larger community – our community in North America, and the world, as we all have relationships and interactions with each other.

British Columbia has an organization called BC Healthy Communities started in 2005, with funding from the BC Ministry of Health. It is part of the international Healthy Cities/Healthy Communities movement. They define healthy communities as follows:

“A healthy community includes a vibrant economy, affordable housing, protected parks and green space, accessible community services, thriving neighbourhoods, clean air and water, a sustainable environment, ethnic and cultural diversity, healthy public policy, engaged citizens” (BC Healthy Communities 2008).

There are other communities in Canada also promoting healthy community. We include another definition from Kitchener, Ontario:

“Healthy community is clean air and water, healthy food, good jobs and safe homes in caring neighbourhoods. It's schools with good teachers and fun playgrounds, parks, bike trails, sports fields and theatres. It is a place where people care about each other, are interested in what is going on, and get involved because they feel responsible for giving something back. And it is a place where social, cultural and spiritual differences are welcomed, a place of peace and social justice, a place where everyone belongs. The quality of our community life is important because we derive physical, mental, spiritual and emotional sustenance - vitality and well-being – from our involvement in community. A community that provides for these basic needs for all of its members, and maintains strong and positive relationships both within and outside the community, is a healthy one.” (Kitchener Community Strategic Plan 2007).



At the 2008 Healthy Communities conference in Vancouver, Dr. Trevor Hancock provided an outline of a healthy community.

He outlined how natural capital is the bedrock of a healthy community and includes 1) high environmental quality (air, water, soil), 2) healthy ecosystems and sustainable resources and 3) habitat and species conservation (Hancock 2008). Hancock goes on to point out that food producers are among the first on the list as the real creators of health in that they provide basic determinants of health.

***A Healthy Community Food System is an Integral Part of a Healthy Community***

Our food production system is part of a healthy community because its living, eating and working together. It is about food safety, food quality, environmental sustainability, enjoying our greenspace, appreciating our diversity. In our community of British Columbia, we have so much diversity – diversity of culture, climate, and the foods that we can grow.

Many of our physical and mental health problems are related to diet and exercise. Our food production system is at least as important our medical system, as far as our individual health is concerned. Are we choosing healthy foods? Do we even know what healthy foods are?

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The region of Waterloo, Ontario have been promoting healthy communities, and has prepared a document “Towards a Healthy Community Food System for Waterloo Region” (Region of Waterloo Public Health, Nov 2005). Their goal is as follows:

“The goal is to create a system in which all residents have access to, and can afford to buy safe, nutritious, and culturally-acceptable food that has been produced in an environmentally sustainable way and that sustains our rural communities.”

“A region with a diverse agricultural economy, linked with local food needs and markets, will be more sustainable in the long term, with lower

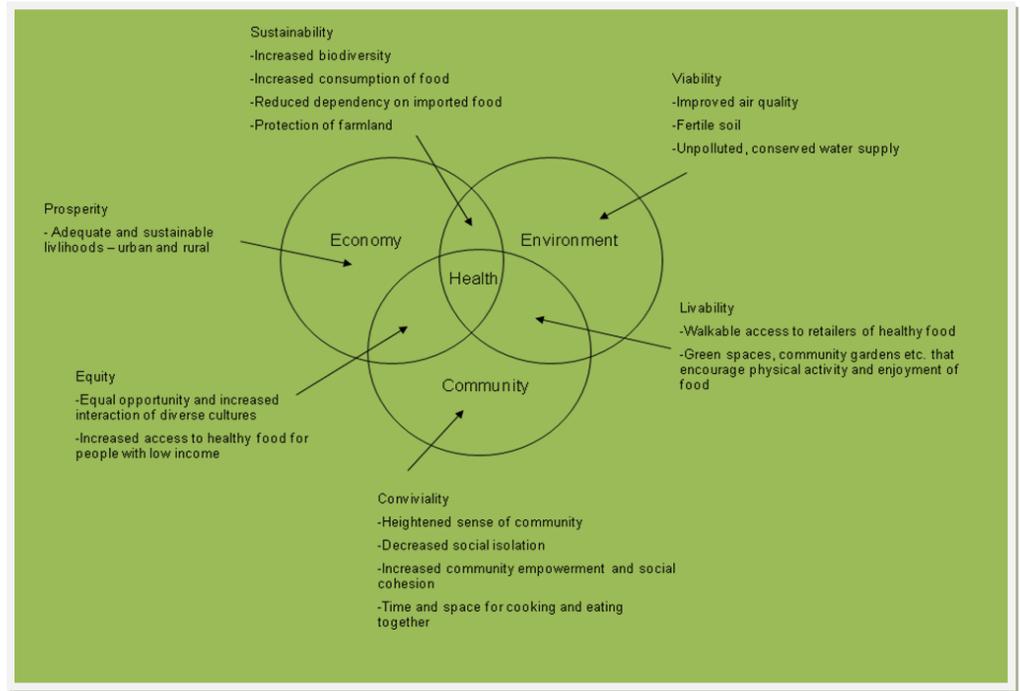
environmental costs, reduced demands on transportation infrastructure, and potentially higher food quality that helps serve nutritional objectives. As well, a vibrant local food economy will help sustain our rural communities and the viability of our local farms.”

Their objectives for a healthy community food system plan include the following:

1. Ensure that all residents can afford to buy the food they need to sustain health
2. Preserve and protect Waterloo Region's agricultural lands
3. Strengthen food-related knowledge and skills among consumers
4. Increase the availability of healthy food so that the healthy choices are easier to make
5. Increase the viability of farms that sell food to local markets in order to preserve rural communities and culture
6. Strengthen the local food economy

The Region of Waterloo has further integrated sustainable food system goals into Dr. Trevor Hancock's healthy community model (Region of Waterloo Public Health 2005)

A healthy community food system relies on a sustainable agriculture. The US Department of Agriculture includes it in its definition of sustainable agriculture as a system "that will, over the long-term: (1) satisfy human food and fiber needs; (2) enhance environmental quality and the natural resource base upon which the agricultural economy depends; (3) make the most efficient use of non-renewable resources and integrate, where appropriate, natural biological cycles and controls; (4) sustain the economic viability of farm operations; and (5) enhance the quality of life for farmers and society as a whole. (USDA, 1990).



In British Columbia, we have the foundations of a healthy community food system. We have the Agricultural Land Commission Act, established in 1973 to protect farmland. We have the Buy BC program, established by the provincial government in 1993 to promote local agricultural food products (Buy BC 2008). We have the SmartGrowth BC program, established in 2000, a non-governmental organization devoted to fiscally, socially and environmentally responsible land use and development to create more livable communities in British Columbia. One of their principles is to protect and promote agricultural land that provides food security, employment, and habitat, and is maintained as an urban containment boundary (Smart Growth BC 2008)

We have to consider that one of our goals as a healthy community is to be part of a larger healthy food producing community.

"The overall goal of the Global Strategy on Diet, Physical Activity and Health is to promote and protect health by guiding the development of an enabling environment for sustainable actions at individual, community, national and global levels that, when taken together, will lead to reduced disease and death rates related to unhealthy diet and physical inactivity. These actions support the United Nations Millennium Development Goals and have immense potential for public health gains worldwide. " (World Health Organization 2004).

**“Healthy soil is the foundation of the food system. It produces healthy crops that in turn nourish people.”  
(FAO 2005)**

## *A Healthy Community Food System Relies on Healthy Soil*

Our foods are grown in soil, which supplies the nutrients and minerals that our bodies need to grow. The quality and productivity of our food supply is dependent on how the food is grown.

“Healthy soil is the foundation of the food system. It produces healthy crops that in turn nourish people. Maintaining a healthy soil demands care and effort from farmers because farming is not benign.” (FAO 2005).

Soil organic matter is the most important quality of our soil that we need to protect and enhance.

“Soil is a living, dynamic ecosystem. Healthy soil is teeming with microscopic and larger organisms that perform many vital functions including converting dead and decaying matter as well as minerals to plant nutrients. Different soil organisms feed on different organic substrates. Their biological activity depends on the organic matter supply.

Soil organic matter – the product of on-site biological decomposition – affects the chemical and physical properties of the soil and its overall health. Its composition and breakdown rate affect: the soil structure and porosity; the water infiltration rate and moisture holding capacity of soils; the diversity and biological activity of soil organisms; and plant nutrient availability” (FAO 2005).

In *Soil at Risk: Canada’s Eroding Future*, we read that up to 50% of our soil organic matter has already been lost from our soils. They define the implication of this as follows:

“Loss of organic matter is of concern because it is such an important component in maintaining agricultural productivity. A significant decline in the soil organic matter content increases the susceptibility of the soil to compaction and to erosion by water and wind. Furthermore, the organic matter is a major source of nitrogen and micronutrients and it increases moisture retention” (Standing Senate Committee on Agriculture, Fisheries and Forestry 1984)

Subsequent work in Canada concludes that through soil conservation and other practices, the loss of organic matter in Canada is approximately 30% (Acton and Gregorich 1995).

In her book, *Under Ground: How Creatures of Mud and Dirt Shape Our World*, Yvonne Baskin writes:

**Soil organic matter provides the health to our soils – provides nutrients, protection against disease, provides structure and water holding capacity.**

“... a spade of rich garden soil may harbor more species than the entire Amazon nurtures above ground .... the bacteria in an acre of soil can outweigh a cow or two grazing above them.

Together [the tiny creatures living underground] form the foundation for the earth’s food webs, break down organic matter, store and recycle nutrients vital to plant growth, generate soil, renew soil fertility, filter and purify water, degrade and detoxify pollutants, control plant pests and pathogens, yield up our most important antibiotics, and help determine the fate of carbon and greenhouse gases and thus, the state of the earth’s atmosphere and climate.” (Baskin, 2005).

Our soil organic matter is not only important for ongoing food productivity, it also affects the quality of our food. We may expect pesticide residues to be lower, and the mineral and nutritional content of the produce to increase. Increased organic matter contents increase soil biology and provide greater disease resistance for plants, which in turn decreases the need for pesticides. Any decrease in pesticides required for crop production is an economic benefit for the farmers, and a potential health benefit to consumers. The use of pesticides used must be weighed against the risks.

“The presence of these residues (pesticide) in and on foods is not contested. The most recent survey results show that nearly half of all non-organic fruit and vegetables on sale in the UK carry pesticide residues. What is contested is just how significant these levels are, the synergistic effects of multiple residues, the extent and significance of residue variability from one piece of fruit or vegetable to the next, and the long-term effects of accumulations of these pesticides in humans.” (Soil Association 2001)

There have been many reviews comparing the nutritional quality of organic foods with conventionally grown foods. Most of the quality changes in food is related to the focus on organic matter quality in organic farming. The Soil Association in the UK concluded that there is increasing evidence that organic food is more nutritious than conventional food.

“The available valid scientific evidence reviewed here demonstrates a clear trend toward organically grown fruit and vegetables having higher levels of desirable components such as dry matter, essential minerals and vitamin C than non-organically produced fruit and vegetables.” (Soil Association 2001)

One example of food quality changes as a result of soil organic matter is documented in a ten year study by Mitchell et al. (2007). They observed that the levels of flavonoids increased over time in samples from organic treatments, which corresponded to increasing amounts of soil organic matter accumulating in organic plots. Flavonoids are a group of phenolic secondary plant metabolites that provide in vitro antioxidant free radical scavenging activity. These authors cite epidemiological studies that suggest that flavonoids protect against cardiovascular disease, cancer and age related diseases such as dementia.

The USDA tables for food quality have changed over the years. Apparently the USDA food handbooks have documented changes in vitamins and mineral contents. There was a 50% drop in the amount of calcium in broccoli, a 88% decrease in iron in watercress, and a 40% decrease in vitamin C in broccoli since 1975. (Faloon 2001). While this does not conclude scientifically that the quality of food is changing, it is clear that our expectation of food quality is not as high as it once was. One observes an interesting correlation between decreased food quality and loss of organic matter in our soils.

Maintaining our soil organic matter is important for reasons other than food production. Soil organic matter increases the water holding capacity of the soil. This benefits communities in dry climates because it reduces the amount of watering required for lawns and gardens (Kelowna, 2008). It benefits communities in wetter climates on hillsides because the soils provide a buffer that reduce water run-off during precipitation events. In our world community, soil organic matter is important in reducing erosion that destroys our top soil and contaminates our lakes, rivers and oceans.

### ***Healthy Soil is Enhanced by the Addition of Compost***

Addition of stable compost is the fastest way to add good organic matter to soil. There are many different ways to improve our soil organic matter including planting cover crops, increased use of forage crops, reducing amount of tillage, use of mulches, and additions of organic matter in the form of manures, plant residues or composts. Fertilizer application also may increase organic matter in some cases because we can expect greater plant growth, with more plant residues being returned to the soil.

Addition of compost increases the amount of soil organic matter much faster than non-composted plant or animal residues because the carbon in compost has been stabilized. Houot et al. (2004) observed this with additions of sewage sludge compost and biowaste compost compared with farmyard manure.

**Addition of a quality compost is the fastest way to add valuable organic matter to soil.**

The Food Agriculture Organization also promotes the use of compost in sustainable agriculture.

“Composting can complement certain crop rotations and agroforestry systems. It can be used efficiently in planting pits and nurseries. It is very similar in composition to soil organic matter. It breaks down slowly in the soil and is very good at improving the physical condition of the soil (whereas manure and sludge may break down fairly quickly, releasing a flush of nutrients for plant growth). In many circumstances, it takes time to rejuvenate a poor soil using these practices because the amount of organic material being added is small relative to the mineral proportion of the soil. Successful composting depends upon the sufficient availability of organic materials, water, manure and “cheap” labour. Where these inputs are guaranteed, composting can be an important method of sustainable and productive agriculture. It has ameliorative effects on soil fertility and physical, chemical and biological soil properties. Well-made compost contains all the nutrients needed by plants. It can be used to maintain and improve soil fertility as well as to regenerate degraded soil.” (FAO 2005)

The quality of our food increases when we maintain our soil organic matter.

In a review of the literature, Biala (2000) concluded that application of 8-10 tonnes per hectare of compost maintained or increased soil organic matter levels in soil. Research in Puerto Rico showed that addition of compost not only increased the quantity, but also the quality of the soil organic matter, thus improving soil quality and productivity (Rivero et al. 2004).

***Composting our Organic Waste is Important to Return Organic Matter Back to the Soil***

Our food scraps, vegetable peelings and other organic waste originate from soil. They represent organic matter and valuable plant nutrients that should be returned to the soil. In California, the California Integrated Waste Management Board is promoting the use of compost because they can expect an increase in soil organic matter and the diversity of the soil's microbial population with regular compost amendment to most soils.

“The composting of organic materials can help remedy this situation by capturing the energy and matter released in the decomposition process. Composting transforms organic “waste” products into a nutrient-rich soil amendment capable of improving depleted or disturbed soil environments. By the intentional act of composting, humans participate in what has been called nature’s “Law of Return” because a vital link is established for the return of organic matter to soil systems. By including composting in human-devised waste management systems, they become more reflective of natural patterns, and more sustainable in the long run. The organic matter resource is conserved, and problematic wastes are converted into a beneficial product that can be sold to help finance the composting operations.” (CIWMB 2008).



Rosemeyer (2005) presented this cycling of organic matter and nutrients in a graphic form that can be easily understood.

***Composting Addresses Global Climate Change and Environmental Quality***

Increasing our soil organic matter is not only imperative for a healthy food production system, it also addresses global climate change and environmental quality. The International Union of Soil Sciences agreed that enhancing soil organic matter is of primary importance.

“Given that enhanced soil organic matter reduces the net rate of increase in greenhouse gases, increases plant productivity, and improves environmental quality, that soil organic matter is a key component in nutrient cycling

for crop production and environmental quality, and is an important determinant of soil physical, chemical and biological characteristics, that our soils, along with water, air and sun are the major resources that sustain our food supply and terrestrial ecosystems, and that global climate change, food security and environmental quality are interrelated issues of importance to all nations and our planet, and these can be favorably and simultaneously addressed by global enhancement of soil organic matter, the IUSS resolves that soil organic matter is a resource that must be restored and increased globally to reduce the net rate of increase in greenhouse gases, to increase plant productivity and improve environmental quality.” (International Union of Soil Sciences 2002)

**Composting reduces greenhouse gas emissions over landfilling by reducing methane emissions and by increasing soil carbon.**

How does composting and increasing soil organic matter reduce the rate of increase in greenhouse gases? Composting has two benefits in reducing greenhouse gas emission compared with land-filling our organic waste. First is that methane emissions are significantly reduced with composting compared to land-filling. A regular landfill allows no capture of methane and a landfill that collects methane recovers approximately 30% of methane produced. Only a bioreactor landfill recovers almost all of the methane. The second benefit to composting is that the compost increases the soil carbon pool, which is the greatest pool of carbon on the planet. Lal (1999) estimated that 55-100 Pg of C has been lost from the soil C pool through erosion and degradation. He estimates that

1.1 Pg C per year can be sequestered in the soil through improved conservation and management. This represents 30% of our annual increase in CO<sub>2</sub> emissions to the atmosphere from all sources. He concluded that increasing soil organic matter is one of the best short term strategies to reduce greenhouse gas emissions.

### ***Developing Sustainable Waste Management and Food Production Strategies***

Understanding the importance of soil organic matter in building a sustainable food production system helps us develop short and long term strategies for our communities. Should we promote backyard composting? Should we develop waste to energy strategies for our waste and rob our soils of the organic matter that they need? Should we promote source separated composting? If we compost, should we compost on the small community level, or in large centralized facilities? Should we compost in our cities, or away from them. Some of these questions have important economic consequences, but also long term environmental sustainability consequences.

Composting should be encouraged in the context of recycling our organic matter and understanding the importance of our soil food system, not simply to reduce waste. Worm composting should be encouraged because it promotes an understanding of recycling food wastes back to soil organic matter. Part of its benefit is the actual recycling, but a significant part is developing an appreciation of the soil food system. The City of Vancouver has a very successful worm composting program which helps our residents understand and appreciate the importance of waste reduction, but also to continually marvel at the intricacies and complexities of our soil food ecosystem.

Backyard composting should be encouraged for those households that are building a sustainable food production system at the household level. Households can be very successful examples of healthy communities that include promoting local food production through vegetable gardens. Encouraging backyard composting in the context of a healthy food production system not only provides local and safe foods, it also increases the appreciation of the complexity of our food production. If we encourage backyard composting only for the sake of waste reduction, we lose the potential organic matter and nutrients, and only encourage rats and other vermin. For example, we encountered a community that was promoting backyard composting as a means of reducing waste to landfill. We opposed this recommendation for several reasons, including increased human health risk from rats (this was in country where rats are prevalent), and increased risk of surface and groundwater

**Backyard composting should only be encouraged in the context of a healthy food production system.**

pollution. In this case, the backyard “composting” was not encouraged as part of a sustainable local food production system.

Urban agriculture is important for many reasons.

“Urban agriculture is becoming a well documented practice in Canada and has with the potential to mitigate several environmental and public health issues, such as storm water retention, food insecurity, urban heat islanding, energy efficiency, air quality, climate change, habitat loss, social isolation and crime prevention.” (World Health Organization, 2002).

Source separation of organic waste produces a higher quality compost.

What about waste to energy strategies, such as creating fuel or electricity? There are many exciting waste to energy proposals being promoted as the answer to reducing waste to landfill. While some of these may have merit, we have to evaluate them on their own economics and sustainability, as well as how they promote healthy communities. Basic questions include understand water, element and energy balances. For example, what is the fate of the nitrogen and sulfur in organic waste. If it is emitted to the air, it may have negative effects on our air quality. If it is scrubbed out with water, it may have negative effects on our water quality. Both of these do not promote sustainable food production systems and healthy communities.

Should we separate our organic waste at the household level, or should we collect all of the “garbage” together and separate the organic material later? It would appear to be much more efficient to collect the “garbage” together and process and separate later. We have observed this with our “blue bag” materials such as glass, tin and paper. A few years ago, we promoted separation of glass, tin and paper into separate containers. Now we encourage placing all of these recyclables in one bag or box and separating them at a central facility. Would this be the same for organic waste? This option was encouraged in the late 1980s and early 1990s as an efficient waste management strategy. Although it is still being promoted by some, there is concern about the quality of the subsequent compost. Compost from municipal solid waste (MSW) that hasn’t been source separated typically has higher metal contents which reduce the quality of the compost. In the context of promoting a healthy food production system, we would promote source separation of organic waste to increase the quality of the resulting compost.

Composting organic waste is an important part of developing healthy communities, but it must be done in a manner that does not affect the health of others or the environment. For some, composting has a negative connotation because of odor. Some odor is inherent in the production of compost, but 99% of the odor potential can be managed. For composting to be part of our sustainable food system for healthy communities, this must include maintaining the quality of our air and our environment. A healthy community model may suggest that composting of the organic material should occur closer to the soils that require the organic matter for sustainable food production, and not necessarily within our urban centers.

### ***Promoting Local Healthy Community is Part of a Global Healthy Community Strategy***

How we live in our communities affects others on various levels up to the global scale.

“An ecological (or sustainable) community may be defined as one which “does not erode the natural capital (air, water, land, renewable and non-renewable resources) of the earth, and whose structure and function result in a harmonious relationship with the local, regional and global ecosystems (CMHC, 1995)

The Rio de Janeiro Earth Summit in 1992 provided some important principles that apply in the context of building healthy communities worldwide.

Environmental protection is an integral part of sustainable community development (United Nations 1992)

“Principle 1. Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 4. In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 5. All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

Principle 6. The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.

Principle 7. States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

Principle 8 To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 9 States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.”  
(United Nations 1992).

Our interaction with others around the world is about building relationships to promote mutual learning, not about us selling technology.

What does this mean for us in the context of waste management and building healthy communities? First of all, it means that we are not the first, nor are we the leaders in promoting sustainable development and healthy communities. We also recognize that we have an obligation to help others in our global community. Encouraging local and sustainable food production provides a model for other communities around the world. It also promotes and provides hope that our food production system is not controlled by a few large companies.

In the context of a global communities, we recognize that many other communities around the world have learned how to build healthy communities much better than we have. We also see that we may have aspects of building healthy communities to offer others as well.

Technology development in the context of healthy communities means participating and discovering better methods that can be utilized in countries around the world. With composting technologies, it may mean technology on a different and appropriate scale in other countries, rather than us trying to market packaged solutions that work in North America. It also means promoting local industry to provide sustainable solutions for recycling organic matter to increase the health of our soils, and hence our communities.

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