

Exporting Rock Rakes to Nepal

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Agriculture is a very broad term that has been used for decades. In this day and age, there are different varieties of modern agriculture from raising livestock to growing crops and everywhere in between. The definition of this term has changed throughout the history of time, however, it has meant the same thing for each and every person living on this planet; food. Every day, three times a day, you need a farmer that can provide healthy and nutritious food to feed families all across the globe. Although there are various countries around the world that cannot provide enough food for its citizens, new farming technologies have been invented so that hopefully one day there will be a stop to this growing problem. New farming practices are constantly being evaluated to be more efficient and more economical while keeping it a sustainable way of life. In Canada, agriculture contributes a significant amount to our economy annually and has a partnership with the United States through imports and exports of livestock, grain, and machinery. Under developed countries do not have a stable enough economy to be able to trade with other countries. A landlocked, undeveloped country located between China and India, that is still dealing with the aftermath of an earthquake that happened in 2015 is experiencing these problems. This country is known as Nepal, and is home to Mount Everest; the tallest mountain in the world. Agriculture in Nepal is slowly rebuilding but, needs help from other, larger countries similar to Canada. There are many ways for Canadians to help the citizens of Nepal rebuild their homes like donating to Red Cross, Habitat for Humanity, The Salvation Army, and Samaritan's Purse. Farmers need our help as well; they need a more affordable way to keep their livestock healthy and efficient tools that will help keep their land free from weeds or stones. At Lee Valley they have designed a Rock Rake that could potentially help Nepalese

farmers cultivate their land so they are free from stones, while being able to stop tillage which could erode the soil.

Part I: *The Rock Rake*

Typically, when Canadian farmers think of a Rock Rake, they think of one that is used behind a tractor. They have long thin 'teeth' (rods) that are close together to gather the rocks



<http://www.leevalley.com/en/garden/page.aspx?cat=2,44821&p=10526>

when pulled through the soil. However, this Rock Rake from Lee Valley is a hand-held gardening tool that is used to pick stones from well tilled soil. Rocks as small as $\frac{3}{4}$ of an inch and as big as 4 inches will be able to be picked up and put into a pile or bucket. The long wooden handle is attached to a steel head that has been curved at the bottom into a basket-like shape, making it easier to scoop the rocks. The hardened steel tines can

flex to different types of soil and

rocks but will not deform the basket. This tool could also be used for farmers to harvest potatoes.

The tool weighs around 1-1.5 lb with the wooden handle having a length of 65 inches and the steel basket being 6 inches wide. The Rock Rake is made in Canada by Lee Valley and sells for \$58.50 CAD per rake. It comes packaged in plastic wrap and preassembled so it is easier to use as soon as it is



<http://www.leevalley.com/en/shopping/addviews.aspx?p=44792>

shipped.

Overall, the Lee Valley Rock Rake would be a very beneficial product for farmers, gardeners, or anyone looking to remove rocks or harvest potatoes from the soil (Lee Valley , 2016).

Benefits to Canada

The Rock Rake is broken down into two components; one being the basket made of steel and the other being the long handle made of wood. The basket is made in one factory here in Canada while the handle is made in another factory in the United States

(R. Graham, personal communication, November 10, 2016).

Here in Canada, steel is one of our major exports and contributes significantly to the Canadian economy. There are many factories throughout the country that employ thousands of



Canadian citizens which, in succession, supply steel products to other industries in different countries or here in Canada (Government of Canada, 2011).

At Lee Valley they have a total of 1,134 Canadian employees that disperse into different parts of the company. They currently have 817 full and part-time workers and 175 seasonal employees. To help create the Lee Valley tools, they have a research

https://www.hera.org.nz/Story?Action=View&Story_id=2089

team of 12 Canadians and a manufacturing team of 130 workers. These different positions throughout the company help aid in the Canadian economy by creating more jobs and generating tax revenue (R. Graham, personal communication, November 10, 2016).

Another one of Canada's major exports is lumber to the United States where the handle of the rake is made. These exports contribute to the Canadian economy and improve Canada's trade barriers with other countries (Natural Resources Canada, 2016).

Overall, exporting the Rock Rake would benefit the Canadian economy by creating new jobs in the steel industry and at Lee Valley Tools. It could potentially improve Canada's trading borders with other countries and therefore benefit Canada as a whole.

Climate Change and Agriculture

Climate change is our past, present, and future. Since the beginning of the human race, we have made an influence on the way the world is today. With the arctic ice melting, the carbon dioxide levels rising, and the global temperature rising; there are new problems for farmers all



<http://www.climatechangecentral.co>

over the world (NASA, 2016). For plants to adapt to the continuous rising of temperatures and keep producing higher yields to feed the expanding world population, there will have to be a large amount of genetic improvements through plant breeding to produce an offspring that have the characteristic to be drought resistance and temperature tolerant (Abelson et al., 1992).

However, agriculture has had an impact on climate change too. In the past, the United States contributed 5% of CO₂ greenhouse gases from agricultural practices such as; the use of machinery, and the oxidation of organic matter in the soil due to tillage. Over the years, farmers have switched from conventional tillage to no till as much as possible to help reduce the amount of gases released into the air and stop the eroding of soil to retain the nutrients for the next crop produced (Abelson et al., 1992).

In Canada our government is researching new technology that will lessen our impact on the environment and will promote the awareness of climate change to our citizens. Climate change will not only impact the environment, but it will impact our economic standpoint as well. The agricultural sector contributes \$50 billion annually to Canada's Gross Domestic Product, and it can be predicted that by 2080 the increase in crops will rise from 1% to 115% depending on the province and crop variety (Ochuodho et al., 2015). Depending on the area of the world which is being heavily influenced by climate change there might be different results in the next twenty years.

Climate change will heavily affect the country of Nepal since it has a fragile environment (Piya et al., 2014). In Nepal there is diverse terrain that has been separated into regions the flat plains, the mid-hills, and the mountains. Each of these regions has a well developed geographic area that has different physical and agricultural characteristics that require different tools for each area (Chhetri et al., 2012).

Overall, climate change is becoming an everyday issue for people around the world. New methods to help reduce the amount of CO₂ being released into the air are being researched daily. With the rising global temperatures, farmers especially will be looking for new crops that will be drought resistant and temperature tolerant to continue to feed the ever growing population on this

planet. As for Canada, since climate change could heavily affect the economic stand point for our agricultural sector, new crop varieties may be released within the next few decades for farmers to be able to help improve the yield of crops and overall, further contribute to Canada's growing economy and agricultural sector. As for Nepal, since it is going to be heavily affected by climate change, new tools and farming practices will have to be considered to help them reduce their impact on the environment.

Part II: *Soil Issues in Nepal*

Nepal is a small country located in southern Asia between China and India. They have a population of approximately 29 million people, compared to Canada that is home to 35 million people. The total land area in Nepal is 143,351 sq. km with 28% of that area being designated to agriculture. Only 15% of the land that has been used for agriculture has suitable soil and growing conditions to grow crops such as rice, wheat, maize, millet, barley, and potato (The World Fact Book, n.d). With different soil types that vary throughout the land arises problems with planting specific crops because of the needs that vary between each plant.

Table 1. (FAO, 1998)

Soils of Nepal	Where it is located in Nepal	Composition of Soil
Alluvial Soil	Found in the mid-hills, and areas near the Himalayas. Also can be found above flood plain areas.	New alluvial soil can have more silt than clay. Nutrient content is higher than old alluvial soil.
Sandy and Alluvial Soil	Valleys of Kathmandu and Pokhara.	Sandy and silty alluvial soil which is fairly fertile.
Gravelly Soil	Base of the Churia hills	Not useful for agriculture since it is pebbly and gravelly soils and therefore cannot hold moisture for plant growth.
Residual Soil	Ridges and slopes of mountains.	Very coarse and can be dry for most of the year.

		Medium to low in plant nutrients.
Glacial Soil	Found in the Himalayan region.	Since it is mostly covered in snow, this soil is rocky and cannot grow plants because of how cold the region is.

These soils in Table 1 show how diverse the soil can be throughout the small country of Nepal compared to here in Canada. The soil in Ontario will not be the same in Alberta, and would certainly not be the same in Prince Edward Island. The different types of soil vary depending on the type of climate in that region.

Since land is a major natural resource for the developing country of Nepal, more than 90% of the citizens depend on the land and farmers to fulfill their needs. Land degradation is a problem that Nepalese farmers have to deal with when flourishing their crops. Land



<http://wwfnepal.org/?206908/Rehabilitating-land--degraded-by-shifting--cultivation>

degradation is when the land quality declines in its potential productivity of growing crops. This can be caused by soil erosion from physical, chemical or biological practices that can or cannot be influenced from human impact (Acharya et al., 2009). Among the other effects listed, wind and water can be a huge factor because they can remove the topsoil and cause soil erosion and therefore a decrease in soil fertility. Aside from the loss of topsoil, this has damaged the land and water resources due to soil eroding down the sides of hills causing thick and sandy plains on the banks of the rivers (Shrestha, 2015).

Different soils throughout Nepal have different components within them that may or may not be suitable for plant growth. Some soils that are up in the mid-hills of Nepal are found in different areas after flooding, landslides, etc. Soil erosion can be from a number of factors including natural patterns, climate change, and human impact. However, with a reduced tillage system for Nepalese farmers in the mid-hill region this could potentially help reduce the amount of soil erosion or runoff that happens annually. Therefore, reduced tillage is an effective way to stop nutrient losses and improve crop yield compared to conventional tillage (Atreya et al., 2005).

Soil Issues in Nepal: Terrace Farming



In the mid-hill region where more cash crop farming is being done, it is harder to plant on elevated land which is why terrace farming has become a more popular practice for Nepalese farmers. This is done by

carving flat narrow terraces into the sides of the hills where the soil is more valuable. The terrace size reflects the wealth and status of a small-scale crop farmer in Nepal which is why this practice is very common. This type of farming practice can also cause issues with soils such as soil erosion, runoff, and nutrient losses. With 95% of the population in Nepal living in the mid-hills and practicing subsistence agriculture, this has led to many sustainability problems with population pressure and soil fertility decline (Acharya et al, 2008).

<http://pioneersettler.com/terrace-farming/>

Benefits of the Rock Rake to Nepal: Who Could Use it?

Throughout the land of Nepal, it can vary from flat plains, to mid-hills, to Himalayas. Just like the land, the soil can vary too and this can make it hard for Nepalese farmers to find soil suitable for growing crops in different regions. Rocky soil can be a challenge for farmers that live up in the Churia hills and on the edge of the Himalayan region because of the soil not being able to hold moisture for plant growth or being too dry to plant at all (Table 1). Typically, the women work the land and perform about 90% of the duties that are done on the farm with or without the livestock. There is a great reliance on the women in the family who are engaged in agriculture because they provide the food and income for the family (Cunningham et al, 2015). Since the men of the family move to the cities to get well-paying jobs, that leaves the women to take on the responsibility to look after the farm and be able to perform the duties of tilling, planting, harvesting, and providing food for the rest of the family (Bhujel et al, 2008).

The Lee Valley Rock Rake would be beneficial for the women to use since it is an overall lightweight tool and makes it easy to pick rocks and stones from the soil. If women were to use it on a vegetable garden, this rake would be more useful as it would be easier to scoop rocks after the soil has been tilled before planting or harvesting potatoes. Children that live and potentially work on the farm would be able to use this rake since it is small and only weighs 1-1.5lb (Lee Valley, 2016). However, since the rock rake basket is small it would take more time to remove the rocks from a large field whether it has been tilled or not.

Benefits of the Rock Rake to Nepal: Environmental

Conventional tillage on the land during the pre-monsoon season (rainy season) to loosen the soil from rocks can cause soil erosion by leaving the soil bare immediately after plowing and

open to the rainfall before the crop has started to grow. The bare soil and heavy rain lets oxygen deep into the soil that will eventually dry it out and loose the nutrients within it (Atreya et al, 2005). During the planting season Nepalese farmers could reduce the amount of soil erosion in their land by using a rock rake to remove the rocks before planting.

Transportation of Rock Rakes to Nepal:

Transportation of the Rock Rakes to Nepal from Canada could be shipped by UPS Air Freight in two ways. One way would be a direct flight from Toronto, Ontario to Kathmandu, Nepal and could be shipped for a total of \$411.70 CAD and would arrive at the destination a week after being shipped from Toronto. Another way the Rock Rakes could be shipped would be by a joined flight and could be shipped for a total of \$372.55 CAD and would arrive again, a week after being shipped from Toronto. Both flights would be carrying 10 units, each weighing 11lb, with the following dimensions: 65 x 6 x 4 inches (UPS Shipping).

Map 1. (La Historia Con Mapas)



<http://www.lahistoriaconmapas.com>

Displayed on this map is the route of the flight from Toronto, Ontario to Kathmandu, Nepal. From the information about the two different flights the best option to export 10 Rock Rakes to Nepal would be to ship on the consolidated flight because even though it would be cheaper to ship, it would arrive in the destination at the same time the direct flight would arrive.

In conclusion, climate change is becoming a huge factor in the way that farming practices will have to be re-evaluated. In Nepal, the continuous use of terrace farming and conventional tillage will increase the amount of soil erosion and soil nutrient runoff that happens annually. Soil erosion can be from a number of factors including landslides, flooding, climate change, and human impact. However, with a reduced tillage system for Nepalese farmers in the mid-hill region this could potentially help reduce the amount of soil erosion or runoff that happens annually. Therefore, reduced tillage is an effective way to stop nutrient losses and improve crop yield compared to conventional tillage. Women and children that work on the farms have to

perform the duties of tilling, planting, and harvesting the crops with or without the use of livestock. The Lee Valley Rock Rake would be beneficial for the women and children to use since it is an overall lightweight tool and makes it easy to pick rocks and stones from the soil or harvest potatoes. It would be a beneficial product to export to the Nepalese farmers because it would greatly aid in the reduction of tillage that happens many times before harvest to loosen the soil and remove rocks. The Rock Rakes could be transported from Toronto, Ontario by air on a consolidated flight to Kathmandu, Nepal. Once this rake has been shipped to Nepal it has already helped the Canadian economy by creating new jobs in the steel industry and at Lee Valley Tools. This could also potentially improve Canada's trading borders with other countries and therefore benefit Canada as a whole.

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