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Bosnia and Herzegovina: Investing in education, training and extension for improved implementation of agricultural research and technology.

Bosnia and Herzegovina was once part of Yugoslavia and, after the breakup of the country, Bosnia and Herzegovina --BiH for short-- exploded into war. This civil war was comprised of the conflict between three major ethnic groups-- the Croats, the Serbs, and the Muslims. After three years of fighting, the conflict was resolved in an agreement that made people tentative. This agreement, The Dayton Peace Accords, was signed on December 14, 1995. Each ethnicity has its own government and military, but a centralized government controls banking and foreign policy. Due to a communist prewar economy the free market economy is still being implemented in BiH. The war devastated the economy sending unemployment rates soaring above forty percent. Much of the populous resorted to agriculture after the war, although they were not farmers before this disaster. Poor farming techniques are practiced as many citizens have little or no modern experience farming. Bosnia and Herzegovina seems an unlikely place for malnutrition and poverty; since the collapse of Yugoslavia, however, it has been present. In order to efficaciously nullify hunger in Bosnia and Herzegovina rural farmers need proper infrastructure and modern technology, suitable methods of coping with the terrain and post war mine fields, and education in effective farming techniques.

Life in rural BiH differs from what we are accustomed to here in the United States. Many rural Bosnians once lived in *zadrugas*-- communal land on which several families lived in an attempt to reduce the work an individual was obliged to provide. After the war, *zadrugas* became unconventional, but community atmospheres within villages are still popular. In rural areas, the average number of people each family consists of is between three and four (The BiH Household). Families are comprised not only of adults and their children, but also their parents (Bosnian Culture). The staple diet of subsistence farmers in BiH consists mainly of crops that are produced on an individual's land, such as grain and potatoes. The majority of protein comes from dairy products --specifically milk and cheese, which may not provide sufficient nutrition. This provides a severe contrast to the average American diet that has much variety and is, on average, too caloric. Many rural families in BiH do not have access to health care due to the fact they are either below or scantily above the poverty line, however; if a family were able to afford health care, they might not be able to receive care outside urban areas ("Bosnia and Herzegovina." *Who.com*). A typical subsistence farmer in Bosnia and Herzegovina has less than three hectares of land or less than seven and a half acres. In the United States the average farm size is over 400 acres (Agriculture) or approximately 53 times the size of Bosnian farms. Small family farms compose sixty-six percent of all farms in Bosnia and Herzegovina. Larger plantation-type farms allow for a greater crop surplus and lesser demand for farmers. On an average farm, the three hectares are divided up among eight to ten plots, which yield a smaller crop (Alibegovic-Grbic). The most important, and most common, crops among these subsistence farmers are cereals, including maize; roots; and tubers, such as potatoes. Despite a large availability of mountainous and grassy lands, which would be appropriate for livestock and dairy, the majority of agriculture is crop based.

Education in BiH is crucial in alleviating hunger. Ninety eight percent of rural students attend primary school, and the literacy rate among youth ages 15-24 is one hundred percent ("Bosnia and Herzegovina"). Since there is a direct correlation between literacy rates and hunger, BiH is in a unique situation. Often an inverse relationship exists where, as literacy increases poverty decreases (United States). Because this is not true in Bosnia and Herzegovina, it is useful in the battle against hunger.

Another contributing factor to hunger in BiH is the hilly and mountainous regions. Hilly regions have rocky soil that erodes easily and leads to further loss of nutrients. Thus the hilly and mountainous regions are prone to erosion, which is aggravated by inappropriate farming techniques (Alibegovic-Grbic). Crop yield is lower in these harsh conditions because of inadequate nutrients in the soil. There are farming techniques, such as crop rotation and planting certain crops, that would prevent further erosion and put nutrients back into the soil. Although the environment cannot be changed to better support farming, agricultural practices can be adapted to suit the terrain.

Hunger remains a problem in Bosnia and Herzegovina due to its inefficient infrastructure, and similarly outdated agricultural technology, which prevents advancement towards a more stable country. Agricultural infrastructure is poor: only 0.65 percent of the suitable land for farming has irrigation (Bosnia - Climate). Irrigation throughout the country mostly consists of only three irrigation systems (Global). Additionally, there is evidence to suggest that climate change, in BiH and elsewhere, is causing increased occurrences of drought (Cardro). Due to Bosnia and Herzegovina's lack of irrigation this could pose a serious problem resulting in loss of crops. After the war in Yugoslavia, seventy percent of Bosnia and Herzegovina's tractors and agricultural equipment were lost (Country Report). Bosnia maintains its traditional agricultural practices, which use a very small amount of both pesticides and fertilizers (Stanojic). Agricultural technology is generally outdated within BiH because there has not been much funding in the last ten years (Alibegovic-Grbic). Lack of biotechnology also limits the country's production of agriculture. There is a strong aversion to genetically modified organisms (GMOs) in BiH and in some regions they are banned completely (Most Nations). GMOs have been shown to increase yields as they protect the crop against pests and environmental factors. In India insect resistant cotton yields, on average, fifty percent higher than cotton without the trait (Do GM Crops). In several areas infrastructure and technology prevent Bosnia and Herzegovina from being able to sufficiently provide for its people.

The civil war left its country in shreds; a country barely able to compose itself was not yet ready to support all of the people, which lead to the problem of land mines left over from the war. These mines often lie on arable land and prevent effective farming. These mines were placed during the war between former Yugoslavian nations (Hendrikaplein). Each mine costs only 2.5 euros to manufacture but between 250 and 800 euros to extract, consequently many mines remain in BiH. The landmines are located on some of the most fertile land within Bosnia and Herzegovina. Unfortunately, when a mine explodes it creates a small crater that promotes erosion of the land and does not allow for sustainable agriculture. These lands worsen the economic situation of many families who own the mine field land but cannot exploit it because of the danger it presents. Additionally when these mines are cleared, the device that is used to clear them destroys much of the vegetation that is present. There has been no major effort to clear the mine fields in BiH, though this would allow for more crop production.

In order to combat hunger in Bosnia and Herzegovina, infrastructure must be put into place, and technology needs to be updated. If there were a water shortage in BiH, it would be difficult to deal with because there is little irrigation infrastructure in place. The World Bank has recently approved a forty million dollar credit for Bosnia and Herzegovina to implement more irrigation should parliament approve the credit. This project would run from 2013-2017 and add ten thousand hectares of irrigation (Stanojic-Eminagic). The approval by parliament would be a significant step towards reducing hunger in BiH and could greatly improve crop yields. In the event that several decades from now the climate has changed considerably, new research will need to be conducted in order to determine congruous crops for the new climate. For instance, if the temperature and rainfall were to increase, then tobacco could be grown or possibly sugar cane. In order to compensate for a large population growth, Bosnia and Herzegovina would need to invest in more efficient agricultural technology to switch from subsistence farming to larger surplus producing farms. Additionally, rural farmers should be given access to GM seeds. These

crops can significantly improve the health and yield of the crop simply by planting a new seed variety. The genetically modified seed could be purchased by the farmer, but it needs to become available in Bosnia and Herzegovina. In order to accomplish this, the government should remove any and all bans on GMOs and disclose to the public that they are not dangerous as once believed. A third possibility that BiH needs to consider is general agricultural technology such as tractors, tillers, and combines. Although this equipment is costly it has been shown to greatly improve efficiency. Since the community atmosphere is great, communities as a whole could purchase this equipment and share to reduce the money each person needs to contribute. The cooperation is initiative provided by the government to promote usage of agricultural technology. There are several ways in which Bosnia and Herzegovina can improve their infrastructure and technologies to improve the quality and quantity of crops.

The education that citizens of Bosnia and Herzegovina already are receiving should be exploited to include agricultural training. There are several institutes in BiH that are offering education and conducting research in Bosnian agriculture. These efforts began before the war but were interrupted by the conflict. Lack of agricultural training is evident in the poverty rate, which is one of the highest in Europe. The literacy rate in BiH is surprisingly high, so it is evident that education is available to most people; however, this education does not cover agricultural practices. A program should be designed where rural students extend their knowledge to farming practices along with core subjects. Educating children will benefit the community several years down the road, but until then working adults must also be educated. The simplest solution for this is to inform people about it in whatever ways possible. This could be done over the radio, on the news or in person. Possibilities could even include free or low cost classes that are provided in rural areas to the farmers. Newspapers or pamphlets could also be distributed to the rural population. Since the people of BiH live in close knit communities, if one person has success utilizing a certain method, others are likely to follow.

Though the physical terrain cannot be changed research should be conducted on the most effective and least erosive farming methods. To optimize the land and each crop Bosnians should be aware which crops grow best in rocky soil--like barley-- and which cause the hills and mountain sides to erode. Erosion can be caused by planting row plants such as corn; these plants only grow in one season and then allow water to wash away dirt for a long period of time. Erosion removes the topsoil, the most nutritious soil. To begin, children of rural communities should be taught which crops are best produced in rocky soil and which are better for more fertile land. Furthermore crop rotation should be introduced, so that the soil maintains the necessary level of nitrogen. Besides this crop rotation assists in breaking up pest cycles, reducing erosion, reduces the need for irrigation, and improves soil tilth ("Resource Conserving Crop Rotation"). Alternative types of farming should be researched further, such as terrace farming, and the most appropriate for each region should be identified. The agricultural practices need to fit the land and then this information must be distributed through some form of education to make it effective.

Finally, mine fields need to be cleared allowing maximum cultivation of the land. In 2003 the UN began a program on mine awareness. As part of this program education on the dangers of these mines is being provided, more personnel are being trained in mine clearing, and more funds are being provided. In March 2009, Bosnia and Herzegovina purchased two land mine clearers, to be operated by the BiH armed forces. Despite increased awareness the number of adult victims has increased from 2007 because people willingly enter the fields in search of firewood, fruit, and iron and other necessities ("Europe & CIS."). In the words of United Nations Development Programme Resident representative Christine McNab, "Even one community highly impacted by mines is one too many, so the work must continue," (GmbH, Arcotrass). As the UN believes, the mine fields in Bosnia and Herzegovina must continue to be cleared. Perhaps an effective way for the work to be accomplished would be to train farmers, whose land has become unsafe, to clear the mine fields. This work would be paid for by the government or outside money such as donations. Once the mines are clear the farmers may choose to return to farming or pursue other careers.

Bosnia Herzegovina Mine Action Center (BHMIC), a group located in Sarajevo, offers hope to the people of BiH. This organization maintains a central database of all the known mine fields; they also offer victims of land mine accidents assistance, raise awareness and educate, and clear mine fields. This organization depends mostly upon donations from other countries. Residents of Bosnia and Herzegovina are very grateful for BHMIC and feel like otherwise nothing is being done. As one woman says:

“We have no other place to live and I do not believe that this place will ever be cleared. Mostar has no money for it and is not interested in these areas here up the hills. We experience the support from the BHMIC as very pleasant. It is important that there are people that listen to us. This way we know that some in this country do care” (Hendrikaplein).

These people have little faith in BHMIC now and have already given up relying on their government for support.

The government of Bosnia and Herzegovina needs to play an active role in the country in order for it to prosper as it can. Parliament should approve the credit from the World Bank for irrigation that would help the crop to be more consistent. The national government should also supply BHMIC with money because the organization is already in place and effective, furthermore the government of BiH should enforce a new primary school curriculum educating students on different agricultural methods that would be useful. Also, the government should pay for radio broadcasts over erosion and selecting the crops for the land. Any American or European charity organizations should also go through BHMIC to ensure that the money is properly spent and put to good use. Rural farmers need to be open minded about new practices and be willing to do something different, because if the farmers do not plant crops more strategically, then the land and effort is wasted.

Improvement in education and training for managing unsuitable farmland will allow people to get jobs demining fields; then, once the fields are clear, they can begin farming. Effective farming will require more education, as the current practices are ruining farmland and not producing ample yield. Clearing mines will allow more farmland and each family will be able to use their entire land without worry. Education about crop practices will then help produce higher yield and ensure the land is available for many years down the road. Providing jobs clearing mines will help Bosnia and Herzegovina's poor farmers who are unable to produce themselves while also allowing other farmers to produce more crops. Ideally, crop yields would increase enough that subsistence farming is no longer needed and the economy expands in other ways to promote stability in the country.

Bosnia and Herzegovina suffers from high poverty rates and malnutrition, which can be combatted through the removal of land mines, implementation of infrastructure, and research and education on efficient agricultural practices. If these are successful farmers will be able to sell surplus crop to markets and gain a marginal profit. From this they can invest back into the economy of BiH and promote economic growth. As with any economic growth plan it requires an initial investment for education and mine removal. In order to solve the poverty in Bosnia we need to create a market in which trade goes both ways and everyone is able to find work. This would work towards the Millennium Development Goal (MDG) helping to eradicate extreme poverty. Consequently Bosnia and Herzegovina will arise from the rubble that war has created in their country.

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