



Final Report for Specialists

Instructions: Please complete the below questions in their entirety. This final report will be used to document your project activities and outcomes. Please note that your completed report will be made available to the U.S. Embassy or Fulbright Commission in your host country as well as the United States Department of State, Bureau of Educational and Cultural Affairs.

Name: Jean F. Bonhotal

Date: 11/4/2019

Host Country: Mongolia

Host Institution Mrs. Kh.Kh., Chairman of the PWDM, Governor's Office and D. Enkh-Otgon, Chair of the Mongolian National Chamber of Commerce and Industry

Project Title/ID: Sustainable Waste Management in Mongolia, Dornod

Dates of Project: August 13 to August 31, 2019

1. How were you matched with your specific project?

- ☐ I contacted my host institution and initiated the project.
- ☐ My host institution contacted me and requested that I serve on the project.
- ☒ The Fulbright Commission or U.S. Embassy in the host country contacted me and requested that I serve on the project.
- ☐ Applied to Open project or World Learning contacted me and requested that I apply to the project.
- ☐ I don't remember.
- ☐ Other

Please explain: _____

2. Did the host institution provide the agreed upon logistical arrangements (i.e. airport transfers, lodging accommodations, meals, and in-country transportation)? If no, please explain.

Yes they were very accommodating. Except for being a vegetarian in a country that consumes extreme amounts of meat I did well and my hosts brought me a hotplate, pot etc to be able to cook in my room when restaurants failed me. Farmers also gave me eggs and vegetables.

3. What specific project activities did you complete during your grant?

See #4

4. What do you believe were the most important outcomes of your project (i.e. what results did you achieve)?

Sustainable waste management in Mongolia, Dornod



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Mining resources from Dornod aimags waste stream before it becomes waste and adding value to those products is the primary goal of this program. Jean Bonhotal, Director of Cornell Waste Management Institute is working under a Fulbright scholarship program from World Learning in Dornod province from August 13 to August 31, 2019. The entire aimags waste audit is important however, we are primarily targeting the meat production industry by studying suitable technology for animal feed production with slaughter house by-products and waste, to assess waste and provide training and advice.

Bonhotal was invited to Choibalsan to work with Mrs. Kh.Kh., Chairman of the PWDM, Governor's Office and D. Enkh-Otgon, Chair of the Mongolian National Chamber of Commerce and Industry. Tours and meetings with Narankhuu and other related specialists to assess the raw materials from livestock slaughter based on traditional technology and scientific basis, to expand and modernize technology. The result will increase economic gain and implement more eco-friendly waste management. 30-50% of each animal is wasted in the local dump which results in great revenue loss, it is like throwing money away. Since Bonhotal does not speak Mongolian a volunteer translator, Sainkhuu Enkh-Otgon was invaluable to this programs' success.

Basic waste audits were completed at slaughterhouses, meat processing plants and meat markets in the aimag. Many livestock by-products were assessed including fat, bones, hides and broth; to make a plan for future action. Rendering of meat byproducts is done in other parts of the world and Dornod aimag wants to develop more for local use and export.

Bones from 121 cows and 301 sheep and goats were collected equaling 4,533 tons of bones. Meat and bone meal (MBM) and bone meal were made with an electric grinder. Half the bones were ground and then cooked and ½ were cooked and then ground. A bone grinder was set up and installed with a crushing device for 47.1kg of crude bones and cooked in a large pot and then bones were crushed in a 60-minute period. The later was more efficient and produced a finer product. Both products were dried in ovens at 66 degrees C and then further size reduced with a poultry feed mill.

The broth from boiled bones was analyzed according to the relevant standards ... nutrients, proteins, fats, oils, acids, minerals, etc.). Product analysis was completed at the National Reference Laboratory of Food Safety and the Veterinary Department of the General Agency for Veterinary Services (EMC) in Ulaan Baatar.

Bones and meat from different livestock species were cooked to make bone and meat broth. Including sheep, goat, horse and beef bone broth. These broths were frozen and will be analyzed for nutritional value for food and animal feed potential. Boiling the meat and bone produces a large volume of liquid fat/oil to rise to the surface of the cooking pot. I would estimate that the facility where we were working currently generates 100 gallons on the days they boil sheep meat(mutton). This oil is not desired for the food value because of taste however it has value for animal feed and for generating heat. **The British thermal unit (BTU) potential of these fats and greases** will also be assessed in a fuel lab. The broth and oils are currently dumped and have tremendous potential for use as fuel or in livestock feed. There would also be an opportunity to collect fryer- fats, oils and greases as a lot of food is fried. We started to



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tally the amounts that may be in Dornod but were told that it is used beneficially, however by the end of my stay we were getting mixed signals about how it is really disposed of. The Ag Department should further study where it is disposed of and capture and collect it. When applied to soil or dumped in holes it has great potential to pollute and again, why dump potential products?

Feed potential for livestock, some of the bone meal was mixed with poultry feed in percentages including 10, 20, 30 and 50% to assess the value of additions of fat, calcium and protein in the poultry diet. Meat and bone meal can also be added to pig and possibly goats and sheep diets. A visit was made to a feed mill in the eastern part of Dornod Aimag to understand the grain mixes that they are currently produced and their potential to add meat bone meal into their mixes. Meat and bone meal is fed to many species to improve dietary nutrition. The mill indicated that they had the ability to mix any rations that were requested and had a container that could be used to feed MBM into the ration.

Visits were made to livestock farms: poultry, pig, sheep and goat farms, some of the farms were already feeding meat and bone meal, so the potential is there to produce meat and bone meal for use in local markets as well as export.

In order to achieve success with producing these products a rendering facility needs to be developed. I see the need for a business incubator where the government might own the facility and entrepreneurs would develop businesses within the warehouse to further process and produce these different products. Bones, fat and meat byproducts could be conveyed to the facility where the bones would be cooked and bone meal, oils, and broth products could be produced. This can be a very profitable business but starting as an incubator would allow entrepreneurs to take a risk and develop markets for these products. The Department of Agriculture and Marketing, farmers and butchers are very interested in changing these waste products into profitable commodities.

Bone and meat by-products are currently hauled to the dump where they are wasted. Self-hauling companies can dump for free. There is good reasoning behind free dumping but it does not pay for the real costs of disposal. Many residents and businesses pay fees for collection and hauling to the dump because a collection company manages it. One of the good things about not having fees for disposal is we avoid illegal dumping in the countryside but when that is the case, there is no money for proper disposal. A concentration of waste in any one location, especially a dump that is used for many years, will result in contamination of air, soil, ground and surface water pollution. In the near future a new landfill will be built in Choibalsan. The landfill will be built a little more securely than the dump but it is important to organize the new landfill and divert all the materials that can be recycled including organics, which can be composted, metals which are valuable need to be baled and recycled. The following are suggestions to collect and organize more categories of materials.

Organics are generally hard to separate from other materials in the landfill except for yard trimmings and all of the meat and butcher waste. The meat and butcher waste come from just a few facilities they can be easily separated and directed to a compost location in the landfill. In order to do that, Choibalsan and all of the other dumps that were very evident driving from Choibalsan to Ulaan Baatar (including the large city dumps), need more resources. They could use equipment for hauling and compost processing but they would really benefit from having set hours with a gate and an employee that directs where each separated "waste product" should be stored. **Metal** (almost all metal can be recycled for value)



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and **glass**(can be ground and used as road aggregate) for processing and sale. **Plastics** may be able to be recycled in China or other regions in Asia.

All organics should be diverted for composting: meat waste (if it is not rendered), fats, oils and greases(FOG), (if not used for heating) yard waste and weedy vegetation, manure, food processing waste and any other organic based material generated in volume. All organics should be composted and used to amend the condition of the range. Soils and range are seriously compromised because of current livestock and human population pressure. Organic matter additions to the soil would only help.

I can't emphasize enough that current waste disposal in Mongolia (mixed dumps) is not protective of air, water, soil, livestock or people. It is cheap and convenient but not protective. Doing things differently takes more work in the beginning so landfill operators may need to having more help in directing the trucks and building piles.

In terms of organics in the old dump, we built piles or a windrow in a selected spot at the landfill where they started to divert and compost the green brush and the butcher and carcass residuals. Two small piles were built as "trial piles" in the hopes that we will continue to compost these materials until they are able to build the rendering plant. We don't have the perfect materials(woody material due to the lack of trees) in Choibalsan, you. Generally you want a chunky carbonaceous material but since these materials are already dumped in the landfill, changes have been made to the process which will work towards facilitating composting. The way bones are prepared in the Butcher operations makes them a possible carbon source, the process will be slower but will breakdown. The chunkiness of the bones will allow air to flow to the microbes that are breaking down the meat, fat and hides. The brush waste will also be used in the pile layers it will help to cover meat waste to keep odor down. It would be beneficial to have more carbon in this process so there will be flies and there will be some odor as these are not perfect piles. I expect that they will still reach thermophilic temperatures. Manure is also being dumped, livestock manure should rarely go to a landfill. It should be used to amend the soil so that pasture, vegetables, fruit and other crops can grow. In this case, manure from animal holding areas is going to the dump so we are using it in a beneficial manner to build the butcher waste piles. If we practice composting in the old dump, it will be common practice in the new landfill until a rendering plant is built.

Glass is a problem because Mongolia does not have a glass recycling plant and glass is very heavy and does not transport well. When any material is mixed into the landfill it is hard to separate, however glass is particularly hard to separate from the landfill. Many countries still reuse their glass bottles especially for beer and soda, these bottles have a deposit on them so that they get back to the bottler and can be sanitized and refilled. Portions of the United States have bottle bills, this is where you pay a deposit for all of your drink containers so that people will bring them back to the store and they can be recycled or reused. In some countries, the glass is ground and used for aggregate in asphalt. It serves as a good aggregate and is a good way to recycle the glass, the streets also will sparkle.

During the last days in Dornod, we visited an institute of learning. The property had greenhouses and gardens that produced a lot of vegetables. They did not have livestock but were interested in implementing animal finishing yards to improve meat volume that can be used. The institute held a seminar on how to properly skin livestock in this case horses to increase the value of the



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hide for use as leather. These materials can be processed in country or exported so that less hides are dumped. **Animal hides** have value and should be handled properly, it is another great revenue source.

Many products were developed during this visit,
Meat and Bone Meal(MBM),
Bonemeal,
Meat broth from different livestock species,
Fats, oil and grease(FOG),
Animal hides,
Feed for livestock, and
Compost to reduce waste and produce a soil amendment to improve overall agriculture potential.

Analyses were completed on many of these products for fuel potential, food for human consumption and livestock feed. Next steps in development should be to assign materials to different agriculture professionals to further develop the products and markets. The infrastructure to better manage waste and landfills in general is outlined. The environmental department that is charged with waste management needs to look at the whole landfill and source separate different materials so that they are managed as resources reducing the waste that needs to be managed, resulting in less pollution.

5. Did you encounter any challenges that prevented you from successfully completing all project activities or achieving all outcomes? If yes, please explain.

We were able to get a lot done as you can see from the full report. But, I think we could have gotten further. The laboratories here allow for chain of custody through approval of govt officials through the inspection service. As a research specialists, I was not allowed to submit samples for analysis and I am not sure how I will get the results. Although, Enhotgon Otgonoo will make sure that I get them as I will continue to help from a distance at this point. There was also a major anniversary of a battle among Russia, Japan and Mongolia which consumed a lot of government peoples' time. Foreigners were not allowed to attend.

6. Do you intend to continue to collaborate with your host institution in the future? If so, in what capacity? Yes as stated above. Lab results are not complete. I am also trying to set up a directed study for my translator a 21-year old college student. I will meet with his advisor and see if they will him credit under my supervision. He spent 3 weeks with me and He will still be doing more work on this community. We do plan to publish an article.

7. Do you intend to establish a linkage (formal or informal) between your U.S. institution/employer and your host institution abroad? If yes, please explain.

No I don't think so, except that there is an institute, The NE Asian Environmental and Research Center that could host Student Interns that could help with furthering the program that was started.



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There would have to be some kind of scholarship program to allow that to happen. Cornell does not really award scholarships but I can discuss it with a few professors to see if it is something that could be arranged. I personally do not have funding to work on any of this I am a volunteer in this.

This report is respectfully submitted by:

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