

Eco Solutions Forge

Story-telling about bringing together modern ecological approaches and the ancient spirit of blacksmithing to produce ideas and products for basic personal needs.

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Abstract

Eco Solutions Forge (ESF) was founded in 2014 as a result of participating in the cewas Start-Up Programme in Switzerland. ESF aims to change the current situation in the Ukrainian Carpathians with regard to wastewater treatment, and to offer sustainable sanitation solutions for the tourist industry in the region. I, Bogdan Popov, the founder of ESF, is an ecologist and blacksmith. ESF is based in Mukachevo, Ukraine. Its main activities are consulting and teaching on water and sanitation issues, as well as designing and building wastewater treatment systems. Additional activities include designing and building public dry toilets and rainwater harvesting systems. Lately, the main focus has been on researching and building high-performance cold climate insulated vermifilters with biochar substrate (biopot). The most noteworthy lesson learned is that offering ecosanitation products must go together with education, since a completely new market is created.

Problem statement

We work primarily for the touristic and recreational sector in Ukraine, especially in the Carpathian region. One of the major problems here (as everywhere in Ukraine) is the lack of centralized wastewater treatment infrastructure, which causes pollution of ground water and water streams. This greatly undermines the recreational opportunities of the region, threatens water supply and degrades natural ecosystems. We strive to offer our customers solutions for treating wastewater and other organic wastes in the most ecologically sound way.

Company description

Eco Solutions Forge had been created in 2014 with the goal of bringing ecological sanitation to the Ukrainian Carpathians. After living for several years up in the mountains and running a tourist eco-camp, I realized

that water pollution is one of the major challenges of this beautiful region. Before moving there, I did not know that situation was so bad. For the most part, Carpathians are associated with clean nature, clean water and a healthy environment. In reality, one will hardly find a stream which has not been polluted, and, to make matters worse, local people themselves are drinking and using the water from their wells which are often polluted. This revelation was shocking to me and I decided to do something to change the situation. I had some experience with composting toilets and grey water in my camp, but my skills and knowledge were limited. So, I decided to learn more about the best sustainable wastewater treatment practices and implement them in Carpathians. The vision was clear – make the water in the streams clean and living again. The mission was to do this through the tourism industry since they have the money to pay. The values were the same as always – taking care of the earth and its people.

Technical data - Biopot wastewater treatment system for the hostel and community centre in Nijne Selishe:

- system is designed for maximum 24 guests staying in the hostel
- no black- and greywater separation (mixed flow)
- the flow rate varies between 500 and 2500 l per day with long idle periods
- wastewater is pre-treated in a two-chamber septic tank, recirculated through the biopot filters and guided into a horizontally constructed wetland (50 m²) for final treatment
- the filtering substrate in biopots is charcoal with addition of earthworms



The first composting toilets

At first, I was very much inspired by constructed wetlands, since they appeared to be the best natural solution for the situation and I liked the idea that plants can purify wastewater. I had a first opportunity to build a small 30 square meters constructed wetland that would treat water from a guesthouse at the mountain pass. It was a great experience to put theory into practice - designing the system, working with the soil to construct a terrace and then actually building the wetland itself. It is at that time that I realized first how important the details are and that, if you want to have things properly made, you have to make them yourself. Hired dredgers might not understand the importance of the details, which can negatively influence the system. The location of the



Figure 1 and 2. Combining ecological sanitation and traditional blacksmithing and functioning Biotpots in winter (source: ESF).

wetland was a rather frequented place since it is a favourite stop for tourist buses. Many people were in need of a toilet, and open defecation was common. That is how

“There was absolutely no smell and visitors of the toilet were quite happy although sometimes wondering where flush button is.” Popov B, founder

I came up with idea to build a public compost toilet and offered that to the owner of the guesthouse. A dry toilet was the best option there since there was a shortage in water supply as well as limited space to treat the wastewater. I used the Clivus Multrum as the base design, which worked well. I did not even expect that my first major toilet project would be such a success. There was absolutely no smell and visitors of the toilet were quite happy, although sometimes wondering where the flush button is. The number of visitors varied, but during the high season it exceeded 400 persons a day. One of the best features of this toilet was the incredible view over the surrounding mountains. Both the view as well as nice music left a very good impression on the toilet visitors. The fact that the toilet offered a paid service did not create any problems, although some tourists expected it to be free. By that time, I had already gone through a start-up course at cewas and set up our agency. I invited one of my blacksmith friends Vladislav Zelenyi (Vlad) to join me. Since that time, we work together as a core team. We share our responsibilities in such a



Figure 3 and 4. The first composting toilet and constructed wetland on the Sinevir pass (source: ESF).

way that I am mostly in charge designing projects and communicating with people, while Vlad works on the implementation side.

The next public toilet I designed was located near Kiev. It was built with the idea to be simple, function without electricity and fit into the natural landscape. The basis for the design was the crib toilet developed by the Green Mountain Club and Appalachian Trail Conservancy (USA). The asset of our design is the use of zeolite as filter under the composting chamber since the toilet was located in a situation with very high ground water levels, and the client wanted to exclude the possibility of pollution. Hand-forged elements for the toilet like door hinges, handles, cloth hooks, etc. made it look very natural and traditional. The toilet worked well and clearly showed that it is possible to achieve proper comfort in the toilet by using only natural ventilation without pipes. However, a weak point was cleaning up the chamber after the composting process. As a result, I developed a cartridge system for the toilet which would enable easier maintenance as well as better composting, sometimes difficult to achieve in a built-in chamber.

Biopot

In 2017, I could implement the idea in the centre of Ukraine's capital city Kiev at Trukhanov island beach recreation zone. The toilet serving an eco-café uses replaceable ventilated cartridges for collecting human waste and allows complete composting outside the toilet chamber. This design got to prove its merits during a period with many users – sometimes over 500 visits per day, and it still rarely developed any smell. This proof of concept evolved in the development of the next generation of cartridge toilets, which we are going to implement in nearest future.



Figure 5. Prototype of the biopot (source: ESF).

Initially, I was very inspired by the technology of constructed wetlands, but I soon realized that the technology might pose many challenges in our context. First, the lack of space in the mountains and difficulties with soil on the steep terrain with available machinery. Second, the lack of proper materials for building constructed wetlands such as graded and washed gravel and sand. A third issue is the performance of constructed wetlands in our climate during winter, when the load on them might be the highest due to seasonal tourism. To address these issues, I wanted to reduce the necessary size of the wetlands through better pre-treatment of the inflow effluent, for which the compact biofilters, co-developed in Norway by Prof. Petter Jenssen, could be very helpful in a cold climate. Inspired by this idea, I started to develop a compact insulated biofilter which would also be a beautiful landscape art object and called it the biopot (Jenssen et al., 2004a, 2004b).

I set the goal to design a closed loop system, enabling recycling of the nutrients contained in the wastewater through use of biochar as a filtering substrate. The biochar, charged with nutrients and microorganisms, is regularly removed from the filter and used as soil amendment. Additionally, the biopot substrate is inhabited by earth worms feeding on organic wastes and aerating the substrate. This project brings together many things - land art and landscape design, sustainable local biochar production, closing the loop of nutrients and vermifiltration of wastewater. A main asset of charcoal is that it can be produced locally from brushwood in a sustainable way.

The first biopots were installed in 2017 in Nizne Selishe, Ukraine, to be part of the wastewater treatment system serving a hostel. The volume of wastewater varies very much with a maximum flow of around 2 500 l a day followed by periods with no influent at all. Black water is not separated. The whole system consists of an 8 m³ septic tank, the biopots used as recirculation filter, and horizontally constructed wetland providing final treatment. Currently, testing and experimentation is conducted to define the best mode and loads for the biopots.

Rainwater harvesting

Along with the biopot project we are setting up rainwater harvesting systems in the area. Shortage of water is an acute issue all over Ukraine, even in the Carpathian mountain region where we mainly work. As centralized water supply still reaches only a minor part of the rural population, most inhabitants rely on wells of which

“Although rainwater harvesting, dry toilets and wastewater treatment are usually considered as different services, when you work in the field you clearly see these resources and waste streams are connected and can't to be dealt with separately.” Popov B., founder



Figure 6. Rainwater harvesting system in Nijne Selishe during construction. (source: ESF)

many go dry during the summer. One of the solutions for this challenge could be the use of rainwater reservoirs. To date, most people do not believe in the potential of rainwater, or they collect rainwater in a primitive way that doesn't provide clean water for safe household use. We think that this could be changed through creation of proper demo examples of rainwater harvesting (RWH) and use. This year, we designed and built a RWH system for the hostel with the biopot wastewater system, to supply its water needs while providing the proper water quality. Rainwater is regularly considered to be waste, but we try to turn it into resources.

Independently of the product, I try to keep our work as open-source as possible, since I am convinced that learning from each other and enabling free access to important information are crucial to make a better world. I use forums such as the SuSanA to present my work and openly discuss it, which has led to many good inputs and helped sharing practical experiences with others.

Building a viable business model

As soon as I decided to be involved with the ecosanitation business I started to look for relevant trainings. Long-term university courses were not realistic for me and I was looking for something really practical, a hands-on approach that would give me the necessary tools to act. Eventually I found cewas – a Swiss based training centre for water and sanitation and enrolled in their start-up course. The studies at cewas were eye-opening. The idea of Eco Solutions Forge evolved during the training - an agency that implements ecological sanitation in the Ukrainian Carpathians and at the same time bears the practical spirit of blacksmithing. We learned about the basics of starting and managing the business, and had the opportunity to meet the people whose articles I was reading before in person. Cewas is a place of inspiration - it combines an informal environment with a highly professional and qualified approach.

Challenges of starting/growing a business

The main challenge is the fact we are working in Ukraine. Ukraine is a poor and backward country, suffering under permanent crisis. The market for ecosanitation (or just sanitation) is still non-existing. Most of the rural people in the Carpathians (and Ukraine in general) do not perceive water pollution as a problem and do not recognize the need to change the situation – all waste ends up in streams and government control is weak. The only practical opportunity is to try to offer sanitation to more or less affluent homeowners and especially hotel owners who are able to pay for wastewater treatment systems. On the other hand, they often choose to forgo the ecological systems for fashionable ones like package treatment plants.

Offering ecosanitation solutions in this pioneer phase may seem too early, since awareness in society is lacking. But if we want change, we must bring the change.

Another issue is the lack of proper materials for building wastewater treatment facilities. For instance, one may face a real problem trying to find the right gravel and sand for constructed wetlands. Working with the local builders also might be a challenge since they often do not follow the building codes and do things with little attention to detail. With ecosanitation, success depends on the details, and small deficits might represent a large problem that could even undermine the entire project performance.

Our reliance on high-quality standards is a main challenge, since it is something people are not used to in Ukraine. We try to achieve the best possible results, not only in regard of the nice outside look but on all levels, such as including only high-quality materials. The outcomes of this might take longer and come at a higher price compared to initial expectations. But we make things to work properly and long-lasting – that is our rule.

Lessons learned as a start-up entrepreneur

I have found that the most crucial thing in setting up the company is **persistence**. So many disappointments and challenges arise on your way that it is very easy to lose the initial inspiration and to abandon the project. This is especially true for pioneers in the country you work in. Of course, you have to be aware of the context you are in and adapt to it, but on the other side you need to learn how to create a protective sphere around you and your work. As R.D. Laing said: "Do not adjust your dreams, reality is at fault".

This is of course the idealistic part of the story. But concerning the practical side, what is really important are your **personal connections** you had before, or that you have created during setting up and running your business. This is probably the best and only way to find customers, since advertisement is difficult to realise at this initial stage and nobody would believe what you offer them unless they know you as a person.

The other thing I have learned is that, in order to get customers, you have to **educate** people. People usually have very little understanding of sanitation in general and ecosanitation in particular. In order to create the demand for a product that will benefit them, education or social marketing is needed. You need to explain to them what is happening with the water they use and what kind of problems might arise from that. Educate about ecology in general and move to sanitation from that. You need to inspire people with the idea that we can together create a system based on natural cycles where nutrients are reused or at least wastewater is treated so it can be safely put back into the environment.

Continues learning is something that needs to be practiced if you want to achieve some results in your business. You have to constantly search for the new information, participate in specialized internet forums and discuss things. Someone somewhere is dealing with the same problems as you and has perhaps already found a solution which they might even be willing to share with you.

Entrepreneurial success stories

In spite of the fact that the initial goal of the ESF was to be involved more with treating wastewater using constructed wetlands – the first successes came with designing and building public compost toilets in different parts of Ukraine. The first toilet was built in 2015 at Sinevir Pass. It demonstrated that dry toilets can save money and, moreover, they can generate income for their owners. This toilet is privately owned and provides paid services. It offers the same level (or even more) of comfort that a flush toilet can provide. The next two public toilets were also successful but much simpler by design. Those experiences demonstrated that even with a low budget, a real composting toilet can be built which works well.

Besides these implementation projects we booked successes in education for sustainable sanitation. In various lectures about ecosanitation in Ukraine during the past three years, the audience, especially younger people, showed great interest.

References

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