



2022 Secretary of Defense Environmental Award Environmental Quality Accomplishments – Individual Soil Erosion Control Marine Corps Base Camp Smedley D. Butler

Introduction:

To train Marines as they fight, MCB Butler must maintain the jungle environment. Unfortunately, Okinawa's intense seasonal rainfall, steep slopes, thin soils, and highly engineered watercourses make controlling soil erosion a challenge. Once soils are exposed and start to erode, covering the ground by hydro-seeding, sodding, and vegetation matting are conventional methods to control soil erosion. These methods may be regarded as environmental friendly, but not always. They often introduce external species to the environment and are not always the best solution for a delicate environment such as the Jungle Warfare Training Center (JWTC) in northern Okinawa, where endangered and protected flora and fauna species live.

Summary of Accomplishments:

Slope Stabilization at LZ 14, JWTC

The Okinawan islands experience separate rainy and typhoon seasons in the spring and summer. Such typical rainfall can be a cause of substantial soil erosion from slope failure or landslides, which adversely impact training activities. After heavy rainfall in August 2020, MCB Butler Environmental Affairs Branch (EAB)'s Soil Erosion Control Manager, Dr. Takeharu Ikema, found a crack running along the top of the slope of Landing Zone (LZ) 14 in JWTC. To prevent further soil degradation that could result in a landslide, Dr. Ikema coordinated with Range Control to limit the use of the LZ, surveyed the site, and developed a slope stabilization design to prevent erosion and secure the safety of the LZ. This action certainly saved the time and cost had the slope failed and secured the safety of the LZ. The direct soil nailing method was employed to stabilize the slope. This method uses geotextile, non-seeded vegetation mat and direct soil nailing without using concrete. The advantages of this method are not only time-cost savings, but it also introduces no invasive species and uses no concrete. As such, native vegetation has a better chance of recovery and its growth will spread to its maximum extent. The work is estimated to be completed in January 2022. In addition to maintaining the LZ's usability for training, this project will aid the environmental conservation of the JWTC and its many protected species.



Survey on the cracked slope shoulder at Landing Zone 14 in the JWTC.

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Advanced Application of Soil Algae

On bare slopes and ground surfaces, applying hydro-seeding is the most commonly used method of protecting exposed soil. Instead of using conventional seeding, Dr. Ikema started to consider the substratum of vegetation and soil. To establish a healthy foundation for natural vegetation, Dr. Ikema chose to use soil algae. Soil algae is a microorganism and thus an excellent producer of organic matter which forms soil substrates of microorganism colonies and naturally nurtures surrounding plants. In November of 2019, Dr. Ikema visited the Ishigaki Island soil algae production plant located 300km south of Okinawa and learned



Visiting the soil algae production plant in Ishigaki Island.

that the soil algae is produced without using any chemicals or synthesized materials. To examine the effects of soil algae, Dr. Ikema sprayed it on the slope of the 300-meter marker area in the JWTC in May of 2019. Geotextile had previously been installed in this area, but after a year, no vegetation had taken root. This soil algae application was the first use in Okinawa and has been a great success in recovering native vegetation on a lean-nutrient slope surface, without introducing nonnative species. Utilizing soil algae also improves soil erosion prevention by forming layers of algae, fungi, lichens and mosses that can replace artificial fiber materials or plastic sheets. Dr. Ikema continues to monitor the progress of vegetation recovery on the slope. As of July 2021, this innovative application of soil algae has kept proving its effectiveness in fostering natural vegetation recovery on slopes where there had previously been no signs of plant growth.



Geotextile installed along slope in 2018, but no sign of germination observed as of May 2019.



Over 2 years after application of soil algae. Surrounding plants naturally began to thrive. (June 2021)



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Testing a Newly Developed Polymer – Collaboration with the Okinawa Institute of Science and Technology

In keeping up with new environmental technologies, EAB is working with the Okinawa Institute of Science and Technology, which is considered to be a leading world-class sci-tech institute. One of their incubation companies, EF Polymer, has developed a natural eco-friendly polymer under the same name as their company. Dr. Ikema visited their lab in February 2021, and learned that its natural-origin based polymer has high water absorbing characteristics. The inventor of the polymer, Mr. Narayan Gurjar, explained that when the polymer is blended with soil, the water retaining capacity of the soil will be enhanced, thus it is expected to suppress soil run-off. The polymer is sourced organic waste such as sugar cane and strained lees of citrus fruits. Tests show that one gram of the polymer can absorb 80 milligrams of water. When blended into soil, the soil's water containing capacity will be enhanced, and the effect will last about 6 months. After that, it will be decomposed and returned to the soil. Dr. Ikema decided to utilize the polymer for soil erosion control at the eroded slope of GP 101 in the Central Training Area (CTA) where a slope stabilization project was contracted in August 2021 and vegetation matting is scheduled in January 2022. EF Polymer will be applied in sections along slopes to be able to compare the difference in healthy vegetation growth within the matting. Further applications will be explored, and there are future plans to test dual use of the polymer and soil algae to develop even more efficient and environmentally friendly soil erosion controls.



EF Polymer made from organic waste of sugar cane and strained lees.



EF Polymer blended with water, showing its water retention capacity.

Environmental Stewardship

Soil erosion control is an important component in maintaining environmental compliance for construction activities. Dr. Ikema is often requested by MCB Butler's civil engineering branch to attend joint site visits and inspections for their construction projects. As soil run-off can be a serious problem to the waters of Okinawa, adequate erosion and sediment controls are imperative to construction activities, especially for the area in the delicate environment e.g. close to reservoirs,



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coastal zones or the JWTC. At the perimeter road sinkhole repair project in the JWTC, where the largest reservoir, Fukuji Dam, is located, Dr. Ikema conducted an erosion control site survey with MCB Butler's civil engineers starting in September of 2020. Also, Dr. Ikema provides consultation review comments and advice for construction projects, such as the road and slope repair projects at Gate 86 in the CTA and LZ 13 in the JWTC. By maintaining strong relationships with other branches, MCB Butler's Soil Erosion Control Program is able to excel at its mission to help preserve Okinawa's natural environment and support Marine Corps training activities.



Checking erosion controls and the project progress at the road repair site at JWTC.