

OPPORTUNITY

This village of Bapugaon is located about 30 kilometers from the southwest coast of India. The village's population consists of roughly 1,000 families of 5 to 6 people per family. While the village has been able to sustain itself over the years partially as a result of government subsidies, there are still various areas of village life that are in desperate need of improvement.

Like many other rural villages in India, the economy of the village is largely structured around its agriculture. Bapugaon's primary crop is rice. Although the abundance of rain from monsoons sustains rice growth, in terms of productivity per hectare, India is ranked 52nd in the world. The depletion of nutrient-rich soil and the burning of residual rice stalks are also concerns.

Furthermore, malnutrition in the village is a major concern. UNICEF estimates that India is ranked 1st in the world in terms of number of children suffering from malnutrition. In addition, the UN estimates that 2.1 million Indian children die before the age of 5 every year. Malnutrition is linked to half of all child deaths and nearly a quarter of cases of disease.

Lastly the prevalence of preventable disease (contagious and water-borne) in rural India in recent years has raised significant concern. Because rural Indians do not have the proper medical resources to address this problem, it is one of the leading causes of death.

Empowering Villages Everywhere (EVE) has hired Horizon Consulting to address the above concerns. They have outlined the following objectives: (1) to improve the quality of life of the village population, (2) to increase individual productivity to attain village self-sufficiency, and (3) to develop village infrastructure for long-term sustainability.

The best recommendation must meet all three objectives. Furthermore, the proposed solution must be easily transportable and sustainable: economically, environmentally, and socially.

RECOMMENDATION

Mushrooms. *Basidiomycota* fungi, popularly known as mushrooms, have two components, a mycelium underground that absorbs nutrients and a fungal fruit or mushroom produced by absorbed nutrients and minerals. Mycelia and mushrooms can address all three issues: mycelium prevents soil erosion, and a mushroom provides vitamins and antibiotic properties to address malnutrition and preventable disease.

Horizon Consulting recommends introducing the *Ganoderma lucidum* species to India. It is rot-resistant, grows 0.3 to 0.6 meters per year, and has the ability to convert cellulose into fungal sugars (mushrooms), which can be consumed by humans. Furthermore, it does not look like any known poisonous species and is indigenous to eastern India and southern Tibet, preventing risk of consuming poisonous mushrooms and any ecological damage.

Agriculture. First, inject *G. lucidum* spores 1.5in into the ground after crops have been harvested. Leave the plant waste in the fields; mycelium will grow underground, breaking down inedible cellulose into needed minerals. The nutrients and sugars from plant waste will either be converted into fungal sugars (a mushroom will grow) or released into the soil to be absorbed by the crops that are planted there next. Furthermore, mycelium provides better hold for the soil, significantly reducing soil erosion.

This process prevents farmers from burning rice stalks before planting the next crop, preserving their lungs; furthermore it significantly reduces soil erosion during flash floods and makes the land more fertile.

Vitamins. As the mushrooms grow out of the plant waste, they will absorb many nutrients which were previously inaccessible. For example, vitamin A from rice stalks is transferred into the mushrooms by the mycelium. Additionally, a single serving of mushroom contains 13% of recommended daily vitamin D and 17% of the recommended daily intake for vitamin B2, which stimulate the immune system. The nutrients provided by these mushrooms are especially beneficial to malnourished children, preventing infant deaths from inadequate nutrition.

Medicine. These mushrooms also have antibiotic and antiviral properties due to an evolved defense against pathogens that attack them. When eaten, the mushrooms are effective against influenza, *E coli*, *Streptococcus*, and other pathogens in humans. In addition, the vitamins present have already stimulated the immune system. Consuming *G. lucidum* mushrooms can simultaneously combat and protect against preventable contagious and water-borne diseases.

Based on a sensitivity analysis, even in the worst case scenario where the yield of mushroom by weight is 1/20th (instead of 1/10th) of rice stalks, each villager will receive 0.2lbs of mushrooms per day. This translates to 15%+ of recommended daily intake for vitamins A, D, and B2.

EXECUTION

In order for this project to be successfully implemented, the villagers of Bapugaon need to be educated about the growth of *G. lucidum* and how to use it to its maximum potential. First EVE will hire five qualified college graduates who speak Hindi to travel to Bapugaon. Each student will receive a stipend of \$100 per month, to cover their day-to-day expenses. Prior to this trip, the students will have already gone through a series of programs which will allow them to become familiar with the growth process and benefits of *G. lucidum* to Bapugaon. While there, the interns will follow up with EVE's local partners weekly, to both ensure their well-being and to keep track of their progress.

IMPACT

This project will contribute 26,130 healthy years to the lives of Bapugaon villagers. This translates to each villager living 0.6 years longer after five years. Additionally, the project has an NPV of US\$36,699, which can be used for expanding this project or EVE's other projects.

Summary (DALY*, discounted)						
Year	2013E	2014E	2015E	2016E	2017E	Terminal
Decrease in years of life lost due to contagious disease	361	348	335	323	311	11,145
Decrease in years of disability due to contagious disease	52	50	48	46	45	1,602
Decrease in years of life lost due to vitamin deficiency	90	92	93	94	95	3,419
Decrease in years of disability due to vitamin deficiency	177	179	181	184	186	6,675
Total	680	668	657	647	637	22,841

Summary (US\$, discounted)						
Year	2013E	2014E	2015E	2016E	2017E	Terminal
Discounted cash flow	(29,958)	20,486	16,716	13,601	11,030	4,823
					NPV	36,699

* DALY = disease-adjusted life years