My Journey Begins: Combating hunger in the Coastal Regions of Tamil Nadu

"The world is full of suffering, it is also full of overcoming it."
-Helen Keller, American Author and Activist

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Introduction

My name is Moriah Morgan and I'm from the very small town of Corydon, Iowa. I am currently pursuing a degree in Global Resource Systems, a program started in partnership with the World Food Prize, with minors in Anthropology and Sociology.

I attended the Global Youth Institute in 2009, something I had been waiting to do since my brother had gone three years earlier in 2006. I remember when he came home and told me all about the important people that he had met and all that he had learned. I was looking through his informational papers when I came across one mentioning the Borlaug-Ruan International Internship. My eyes opened wide with interest and amazement. I was astounded to see that a high school student could do such things. I knew that an opportunity like that was something special. "I'm going to get this." I told my brother. "That's what I want to do, right there." Finally my junior year came around and my Talented and Gifted teacher, Lorena Blount, asked if anyone was interested in writing a paper for the World Food Prize. My hand shot into the air.

The World Food Prize was everything I had imagined and more. I returned home, my desire to become an intern anything but sated. I pulled out my computer and began the application process. A couple of months later I received a letter informing me that I had not been accepted as an intern, but it encouraged me to get some more education and try again the next year.

I had loved every part of the Global Youth Institute and I was positive that I wanted to continue on with it so I pressed forward, determined not to give up. I wanted to make a difference in the world and I knew that I wanted to start with the World Food Prize.

Being from such a small town, there were very few science classes available so I turned to online college classes, taking Basic Anatomy and Physiology to add with my high school Physics. I applied again the next year and was soon thrilled to discover that I would be traveling to Chennai, India to work at the M.S. Swaminathan Research Foundation (MSSRF).

About the M.S. Swaminathan Research Foundation

Food: a need that no country is a stranger to, but for countries like India, there are increasing issues. As population grows, more food is needed. For India, this posses a great problem as it is projected that in the next twenty years, the most common face in the world will be Indian.

1/3rd of the world's hungry live in India with 5 Indians dying every minute from hunger. The MSSRF, started in 1988, is working to combat this problem through pro-nature, pro-poor, pro-women, pro-sustainable on-farm and non-farm livelihood. To do this, they initiate the use of ecotechnology and knowledge empowerment in rural communities. One way the foundation is working towards helping India is through an evergreen revolution which involves an enhancement of productivity in perpetuity without associated ecological or social harm. This is where I found the concept of integrated farming.

Supervisors and Specialists

I worked with a number of people while in India who helped me compile my research and create my presentation.

- **Sudha Nair**: JRD Ecotechnology Center Senior director. She is in charge of all the projects at the JRD center and my supervisor during my stay. She assisted me decide my general area of study and helped me refine my research.

- **Dr. Krishnan**: The head at the Fish-for All center in Poompuhar. He was my supervisor during my field work and was a big help in narrowing down my topic from coastal studies to integrated farming.

- **Selvarasu Thangarasu**: The Integrated Farming Systems specialist in Poompuhar. During my stay, he was my translator and reference for my field work.

- **Philip Santhakumar**: A senior researcher in the MSSRF working in the Insect Pest Management Lab (IPM). During my time in Chennai, I also participated in some of Philip's insect pest management experiments.

My Work at the MSSRF

I arrived in Chennai with basically no clue what I wanted to work with, but after sitting down with Sudha Nair, my supervisor, we decided that I would focus on coastal research for my main research project. After reading through the coastal section in the library, I headed out to the Fish-for All center in Poompuhar. My supervisor there, Dr. Krishnan welcomed me like family and we sat down to discuss the specifics of my project. The center has many different projects going on currently, such as the fish processing center which will help with maintaining sanitary storage and preparation of local fisherman's catch. Though everything sounded interesting, one project stuck out in particular: the integrated farming system.

In 2004, much of the east coast of India was destroyed by a tsunami. Fishing communities like the one in Poompuhar were traumatized. Relief efforts built homes for the displaced people and life began again, but people had now realized that they needed a safety net. With the integrated farming system, the people of Poompuhar have just that. If fish is fetching a low price, they can depend on horticulture; if the paddy crop is poor then they have poultry, goats and cattle for income security. Integrated farming also protects from another scenario; as the people of the coastal community got back on their feet after the tsunami, the fish were plentiful in the ocean. People flocked to the boats, eager for a big catch. As this continues it will soon become an issue of overharvesting. Once again, the integrated farming system will protect against this issue.

What is the Integrated Farming System?

Integrated farming system or IFS, is a system devised for maximum output and waste management in small spaces. The different components depend on local resources as well as the ingenuity of the practicing farmer and the market opportunities. A typical farm has two or more of the following aspects: fish farming, poultry, livestock (cattle and goats), vegetable crop, tree crop, paddy crop. Each part of the farm is used to its full potential and nothing gets wasted. This system allows for a more organic farming structure. As a result, the amount of organic carbon in the land is increased, providing healthier livestock and crop.

Top Layer:
Catla (≈200), Silver (≈ 200)

Middle Layer:
Rohu (≈ 200), Grass Carp (≈ 200)

Bottom Layer:
Common Carp (≈ 100), Mrigal (≈ 100)

In a general IFS system, the first aspect will be the fish pond. It will usually consist of six different fish species that stay in three general layers of the pond depending on their feeding habits. By storing compatible fish with different feeding habits in a polyculture system, each species thrives without harm to the other fish.

A typical farmer will have 600 to 1000 fish fingerling in a pond ranging from a 30 cent to 60 cent area with a stocking rate of one fish per square meter. A fish production of 1,500 kg per acre is expected at harvest and the fish are either sold for profit (100 rupees per kg.) or kept for family food consumption. The Indian Major carps - catla (Catla catla), rohu (Labeo rohita), mirgal (Cirrhinus mirgala) and the exotic carps - common carp (Cyprixnus carpio var communis), silver carp (Hypophthalmicthyes molitrix), and grass carp (Ctenopharyngodon idella) take from six to eight months to grow to appropriate harvesting size (1.5 – 2 kg).

The pond itself also has many benefits. Ponds often provide a very valuable source of water for the farmer or even the community the farm is located in. It increases the amount of ground water and rainwater which can be used for irrigation purposes by pumping water to vegetable and tree crops. Another option is after the fish harvest, the water can be drained from the pond and transferred to the farmer's paddy fields. Another main benefit of the pond is its use for recycling waste such as poultry droppings and dung/ urine from the livestock raised alongside the pond.

The next component is the poultry. A suspended poultry house can be used for greatest benefits. With this, droppings and food not consumed by the chickens falls down into the lake, feeding the fish and fertilizing the pond (70 to 72 weeks = 25 kg fertilizer). This saves the farmer money otherwise used to feed the fish. Not only does using a suspended house save space on his farm, but also restricts the chicken's movement. This causes the chicken to increase production while decreasing food consumption. The eggs from the poultry can also

Suspended poultry house

be collected and sold for profit or used for family consumption. The farmer also has the option of selling the chickens or using them for family consumption. A chicken produces 12 eggs and 1 kg of meat from 2 to 2.5 kg of feed. They begin producing eggs after 20 to 22 weeks and meat production begins after 7 to 8 weeks. The chicken are generally fed a combination of crushed wheat, rice polish, sesame oil cake, fish meal, salt, clam shell powder, and azola which is produced on the farm.

Instead of the suspended poultry house, another option is the deep litter system in which the chicken is raised in the shade or on a pond dyke. In this system, the poultry dropping are still used to fertilize the pond and feed the fish, but the farmer must gather the waste and put it into the pond by hand. Chickens raised with this system typically lay 10 to 15 less eggs per year.

Though none of the farmers I interviewed used this, duck farming can also be done instead of chicken farming. When ducks are added, water plants are kept in check and fish feed costs are reduced by 50%. Ducks also loosen the bottom of the pond which releases nutrients and increases the pond productivity, helping aerate the water. As they will eat small fish, an integrated farm with ducks must be stocked with fish of larger than 12 cm.

Livestock integration is a very useful part of the integrated farming system. In including cattle and goats in the farm and using their dung/urine as fertilizer around the lake and plants, the farmer gets increased soil fertility. Other uses include drying the dung and using it for a cooking fuel. Out of all livestock options, the cow produces the most excreta at 14,000 kg feces and 1000 lit urine/yr. Using the cattle waste as a bio gas will satisfactorily provide for the family's fuel and electricity needs. The farmer may also collect milk from the cattle for market or family use. A cow will generally produce from five to seven liters per day.

Local Breed

The goats are often sold for food as their low fat content puts them in great demand. Though in the farms I visited, goat milk was not used, the goat's ability to convert food to milk is greater than cattle and the goat requires 1/5th the daily ration of cows. The dropping of 20 goats is enough to produce the amount of gas needed to cook food for three people.

Another option is pig rearing. This provides a cut in cost required for fish culture by 50% and also a way of disposing of household wastes as a food for the pigs.

The farmer will also have a number of crops around the pond such as, but not limited to:

Fruit Crop: Banana (Musa species), Coconut (Cocos nucitera), Sapata (Manilkara achras), Guava (Psidium gujava), Papaya (Carica papaya), Jack Fruit (Atrocarpus heterophyllus), Citrus Fruit (Citrus species), Mango (Mangifera indica), Gooseberries (Emblica officinalis).

Vegetables Crop: Tomatoes (Lycopersicon esculentum), Brinjal (Solanum melongena), Chillies (Capsicum annuam), Drumsticks (Moringa oleifera), Ladies Finger (Abelmoschus esculentus), Bitter Gourd (Momordica charantia), Snake Gourd (Trichosamthes cucumerina), Amaranthus (Amaranthus species), Cluster Bean (cyanopsis tetragonoloba).

Trees Crop: Teak (Tectona grandis), Casurina (Casurarina equisetitolia), Eucalyptus (Eucalyptus tereticorruis).

Fodder Crop: Hybrid Cumbunapier Grass (Co3, Co4), Water Grass, Stylo Santhus, Agathi (Sesbania grandifola), Subapul (Leucaena leucocephala).

Many farmers will also grow paddy crop which is a staple crop of the area.

The crops provide a profit for the farmer, as well as provide materials for the family. Typical production after 12 months of banana is 1 - 2 tons, potato 2 – 2.5 tons, coconut 3 – 4 tons, papaya 4 -7 tons, and vegetables 1 -1.5 tons. Banana leaves can be used as feed for the fish in the pond, thus decreasing feeding cost. Farmers may also produce azola, which can be used as poultry food and as a nitrogen-fixing agent in their paddy field.

At the bottom of the integrated pond, 35-42 cm of silt composed of extra feed, manure, animal excreta as well as dead bodies of animals and plants is accumulated per year. Proper application of this silt to the crops 6 – 8 times a year reduces the production cost by 1/3rd and decreases soil erosion up to 60 – 70%.

An integrated farm may also include vermicompost production, a type of organic fertilizer produced from manure and decomposed by worms. Another option is biopesticide production, another organic fertilizer composed of neem

Biopesticide Production

leaf, ada thoda, nochi, ecru, pongam leaf, peakllagatha, mixed with water and cow urine then left to set for fifteen days with systematic mixing. In using less chemical fertilizers, the farmer prevents the fish from having biological chemical residue, thus leading to healthier fish and better growth rates. This form of fertilizer is also free for the farmer.

Honey production and jasmine production are other possible income revenues. The Fish-for All center also plans to pull the system closer to the coast and implement crab fattening as another factor sometime in the future.

Through the use of the Integrated Farming System, the hope is that the coastal farmers of India will have a constant more stable source of income throughout the year, receive a greater income, and require less outside factors such as chemicals. This would give the coastal community of India food stability in an unstable area.

Poompuhar and My Goals in the Village

Poompuhar was chosen as the location for the Fish-for All center because of its historical significance. It sits right on the edge of the coast and is home to a large collection of temples and historical structures, many from the Chola era. It is also home to a current archeological excavation as the people have set to work analyzing the city of old Poompuhar, now buried deep under the sea after a devastating tsunami almost one hundred years ago.

Local villagers waiting for the boats to come in with their catch. The villagers will examine the fish and decide if they want to purchase.

This village is ideal for the integrated farming system as it does best in a site out of range from flooding, but not far away from water resources. My goals while in the small village were to:

1. Gain understanding about the lifestyle of the coastal farmer and his family members
2. Distinguish between the rolls of the coastal woman and man
3. Analyze the benefits and issues of the integrated farming system.

The system is new to most of the people of coastal Tamil Nadu and many farmers that I spoke to were only in their first year of implementing the system. It has, however, been catching a lot of attention from the local people as it holds many benefits for the owners.

Research Findings

Throughout my stay in Poompuhar I conducted a number of interviews to analyze the integrated farming system. The farmers showed me around their property and told me about the different aspects of each of their farms.

Farmer	Age	# of workers	Total land area in acres	Total pond area in cents
Thilagar	54	1	7	30
Ramamoorthi	49	5	10	50
Ravichandran	46	1	5	60
Jayaraman	60	2	40	Two – 30,30
Renganathan	61	2	3.5	30

Most farmers worked by themselves or with the help of their family. This is a good way for the coastal farmer to save money on labor, but it presents a problem for the family. I spoke with one farmer's son who expressed that since his family farmed, it was not possible for him to ever go into a different profession because his father would then have to hire another worker. Contradictorily, one farmer's wife expressed that the amount of money they received from the farming made it possible for her to get along fine with only one son. Previous generations had needed many children for labor on the farm. The integrated farming had, as a matter-a-fact, been going so well for this particular family that the son had gone to work in Chennai.

- **Livestock**

I spoke with the farmers about the livestock on their farm. All had cattle; only one had no poultry and two had no goats. By owning livestock, the farm has a great many available income options. Livestock is also valuable because after the initial purchase, the amount of livestock will multiply, increasing the family's net profit with minimal investment.

Farm	Cattle	Goats	Poultry
Farm 1	3 : 2 dairy cows, 1 calf - local breed	6: 3 male, 3 female – Thalacherry breed	33: 13 male, 20 female – Girinja breed
Farm 2	5: -local	None	150: 20 male, 130 female – Giriraja
Farm 3	10: 6 female, 4 calves – local	14: 4 male, 10 female – Thalacherry	30: 6 male, 24 female – Giriraja
Farm 4	3: 1 male, 2 female – local	2: female - local	100: Chicken – Giriraja. 300: Broiler Chicks 15: Turkeys
Farm 5	4: 2 - Jersey breed, 2 calves – local.	None	None
Farm 6	1: female – Jersey	1: female - Thalacherry	30: 10 male, 20 female - Giriraja
Average	4	4	110

Note: Farm number 4 was originally a poultry farm breeding chickens for consumption.

- **Farmer Benefits**

The farmers had a number of good things to say about the integrated farming system.

Benefit	# of farmers out of 6
Increased Income	5
More water (groundwater, rainwater) used for irrigation or consumption	4
Increase in materials	3
More food for the family	3
Increase in social status	2
More employment opportunities	1
Better soil fertility	1

83% of the farmers felt that their overall income had increased with the application of the integrated farming system. The increase in income is used for such things as education for their children or put into festivals and marriages.

- **Farmer Issues**

While there are many benefits to integrated farming, farmers are still facing a few issues in their occupation.

Issues	# of farmers
Not enough return income for repair or expansion	3
Not enough man power	2
Lack of power, constant outages	2

33% of the farmers felt that the power outages were a major problem. In the rural area of Poompuhar, the electricity will go out multiple times a day often times for three or four hours. This causes problems with the irrigation system and farmers have resorted to using a pedal pump. The MSSRF has helped provide many farmers with this manual system which pumps water out of the fish pond into a small channel leading to the farmer's other crops.

Top: Power necessary irrigation system
Bottom: Pedal Pump

Women of the Household

In India, once a woman marries a farmer, she is expected to quit whatever job she may have had before and take care of the house as well as help on the farm. Out of a typical twelve hour work day, five hours are spent doing household work and the other seven are spent working on the farm.

The chart below shows some of the woman's tasks which vary day to day.

Household tasks	Farm work
Feeding the family	Feeding the Livestock and fish
Drying and storing food	Milking
Cleaning	Cleaning livestock shed
Washing	Sewing/planting
	Weeding
	Tilling
	Irrigation

Whether they are wives of fishermen or farmers, the women are in charge of the marketing. In a smaller farm, the yield will first go to the family and what is left over will be taken to market. Once the crop is sold, the money is then given to the man of the household.

The woman has no say in the farming decisions, but holds more influence over the household decisions. When a large issue arises in a household, the man and woman will make the decision together.

Case Study

Name of Farmer	Village	Components	Cost of Cultivation	Gross Income	Net Income	Employment Generation
Thilagar	Nemmeli	Crop, Poultry, Fish, Crop Cultivation	27275	43800	17235	274 (man days/year)

- **Crop Calendar**

Crop	Season	Variety	Yield (Kg/acre)
Paddy	Kuruvai (May to August)	IR 50 ADT45	1500 – 1800 1700 – 1850
	Samba (September – January)	Co 43 – transplanted	1300 – 1500
		ADT 38 – transplanted	1500 – 1650
		ADT 43 – transplanted	1350 – 1450
		BPT (Andra ponni)	1750 – 2000
	October – January	ADT 38 – direct sowing	1000 – 1200
		Kuzhivedichan - direct sowing	400 – 600
Rice fallow Blackgram	January – March	ADT 2	300 – 350
		ADT 3	400 – 600
Rice fallow Cotton	January – August	LRIA 5166 Hybrid	2500 3000
Green Gram	January – March	ADT 2	300 – 350

		ADT 3	400 – 450
Groundnut	December – January	VRI 2	800 – 900
		Polachi 1	700 - 750
		JL-24	1200
		VRI-2	1100
		VRI-2	800
		JL-24	900
Vegetable	February – March	Cluster Bean Hybrid	4000
		Bitter gourd	5000
	June – September	Tomato local	6000
		Brinjal local	8000
		Bhendi-Arka Anamika	4500

Generally in an integrated farm, the family will first take yield for family consumption and the extra food will then be taken to market.

Food	Family consumption per year
Rice	600 kg
Green Gram	30 kg
Green Gram	10 kg

Note: The Thilagar family did not include fish consumption as they are vegetarians.

Effects of the Program

In implementing this system, the MSSRF has greatly increased food security for the people of coastal Tamil Nadu. For a village that has long relied on the fish that come in from their coasts, it holds a promising future. With this system, not only do they have water and food for their family, but a waste recycling system. No longer do they have to worry about what they will eat if a component of their crop fails and because of this innovative system, cost of food and fertilizer is sufficiently decreased. Food also becomes healthier with the application of organic fertilizers and absence of chemicals.

The MSSRF is also planning on installing an example integrated farm near the Fish-for All center in Poompuhar so that anyone can come and see the benefits first hand. It will also allow farmers to be trained first hand with valuable farming techniques. What's more, it will empower the farmers of Tamil Nadu. As one farmer teaches another, a type it builds a better self relying community.

Insect Pest Management

During my time in Chennai, not only did I sit in on conferences such as portions of the three day mangrove conference speaking on many various topics including climate changes effect on mangroves, but I also partook in some insect pest management (IPM) experiments. The IPM separates its components into three main sections: Self Help Groups (SHG), Lab findings, and Fieldwork. In SHG, the IPM will analyze a specific crop in which there is a pest problem. Once this pest is found, the scientists will work to discover a beneficial insect that may be introduced into the crop to compete with the pest. They will provide the SHG, composed of local poor women, with this information, and the women will mass produce the insect to sell to the farmers. In the most recent case, the Trichogramma chilonis was introduced to kill a large range of moth species which were causing a significant amount of damage to yield. The Trichogramma chilonis will lay its eggs inside the egg of the moth which subsequently kills the moth.

In the lab findings section, they are currently working on bacteria controls. They are working to discover what kills Helicoverpa armigera by removing the rizosphere directly below mangrove and paddy plants and isolating the 500+ bacteria found there. Once each is isolated, they will introduce it to the insect and study the effects of the bacteria. If a bacterium is found to kill the insect, then they will further break down the bacteria to look at the specific component that is responsible for killing the insect. This component must also be proven biosafe before it is ready for use.

In Fieldwork, the scientist have been traveling back and forth between the three neighboring state to collect Helicoverpa armigera and samples of the rizosphere. The rizosphere is important as the root is in direct contact with this area. The IPM has one other current endeavor in the field work component. The Moranda citrifolia is a plant gathered for its medical properties witch inhibit the growth of cancer cells known to cause blindness to infants while still in the womb. This plant can only be found in specific locations and is very valuable, thus, the researchers at the IPM have been looking into the plant, analyzing its surrounding habitat, in an attempt to protect it.

My Journey

Now that I've come back to America, it's not uncommon for people to approach me and inquire, "How was India?" I will often respond, "Hot," or "Awesome," but that only just scratches the surface. What India was to me is not a subject I can encompass in a simple passing conversation.

"Like nothing I'd even seen before," might be a good comment to start with. The memories of my time in Tamil Nadu are still very vivid in my mind; starting with the plane ride. I had never traveled outside of America before, I had never even been in a plane, and here I was waving goodbye to my parents as I embarked upon a near 20 hour plane ride all alone. I was nervous that something would go wrong as I went through security and praying that I wouldn't get sick on the plane. I needn't have been worried though.

As the first plane finally took off, it was hard to keep the smile off my lips and I was sure that the way my face was practically glued to the window made it obvious that I was a first time flyer.

I had stops in Chicago and Brussels before I landed at two in the morning in the bustling airport of Chennai, India. I recall wondering as I first stepped outside, 'how could it be so hot so early in the morning?'

India, even at such an early hour, was alive. Everything was so different. Cattle lounged on the sides of the roads among piles of trash thrown nonchalantly here and there. People walked around without shoes and took naps on the sidewalks. Then there was the driving… I thought for sure I would be in a head on collision multiple times. I saw a lot of things that were just like us here in America: people rushing around speaking rapidly on cell phones and friends meeting to go out for dinner. Yet there was so much about the way that people lived in India that was different from what I was used to.

I met an American while I was there who told me a story about a small farming family she had once met. They supported themselves entirely by the profit they gained from selling their hen's eggs. At times they might only have one egg gathered, but they made due and were genuinely happy people. When the American came to visit the family, they wanted her to eat their eggs. It didn't matter to them that they might not have any income for the next few weeks, what was important to them was hospitality. This was just one of many admirable traits I saw.

Everywhere I went, I was welcomed like family. I never once felt like I was in the way, rather, at times I actually felt like a celebrity. During a seminar in Poompuhar, I participated in the presentations. Afterwards, several village farmers approached me with their farm books wanting me to sign them. "Autograph, autograph," they said.

I will never forget my time in India. From the day I spent in Mahabalipuram wandering among stone temples with my friends, to trying my first coconut tender on a small farm in Poompuhar. The people of India welcomed in into their homes, inspiring me with their stories and dreams. I can't imagine a better start to my future than what the World Food Prize gave me the opportunity to do at the M.S. Swaminathan Research Foundation, and I can't wait to see where my journey leads me next.

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