AGRICULTURE

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Here are the global and the local problems: a growing population, increasing urbanization, degraded farmland, and destruction of important ecosystems for more farmland. On a global and a local level, we need to control population growth, or at least not encourage it by pushing urbanization, especially of farmland, and we need to farm in more sustainable ways. The old slogan, Think Globally, Act Locally, is still relevent. See and understand the big picture, how we are part of it, and work for changes at a local level.

In 2008, when a middle school class came to our farm, the current world economic problems were just starting to get noticed. So how does all this economic stuff relate to agriculture? Well, there is a big push to get the housing market going again, but that will just put us back on the same path we have been on for a long time. Since 1970, the U.S. has been losing farmland to urbanization at the rate of 2 acres a minute, or a bit over a million acres a year. The Central Valley of California, which grows one-quarter of the nation's produce, is losing 15,000 acres a year to development. Sustainability? During the Waiāhole water case, we found out that the State does population projections based in part on what our main economic drivers need to keep growing. In other words, the State promotes population growth to keep the construction industry healthy, even though State and County plans call for limiting population. In the late 1990s, when Hawai'i's economy was down, population growth was at zero for the first time. Construction workers went to places like Las Vegas in droves because of the demand for housing by a population growing at the rate of 50,000 a year.

"Luckily" another housing boom in Hawai'i started. So this is what is going on in the U.S.-Keep the population growing. Build more and bigger houses—from 1982 to 1997 the U.S. population grew by 17 percent, but the amount of land urbanized grew by 47 percent. Buy food from all over the world. The U.S. became a powerful nation in large part because it has the most good agricultural land in a favorable climate zone. Unfortunately, while the industrial agricultural model can produce copious amounts of food,

it has been equally good at degrading our environment through pollution of our water resources from excessive fertilization and the loss of valuable topsoil due to excessive tillage. There is of course much more about food systems, and Michael Pollan, Paul Roberts, and others have written about it very eloquently.

FOOD, GLORIOUS FOOD

Everybody's talking about food these days. We constantly hear that 85 percent of locally consumed food is imported. We also hear people talking about organic, local, additives, GMOs, corn syrup, sustainable farming, factory farming, frankenfoods—enough buzz words to confuse even an educated reader. So what's a kid to think?

Those students who came in 2008 were the inaugural class of "Roots—Where Do Things Come From and Where Do They Go," led by teachers Bob Tam and Emery Mitchum. Designed to trace the life cycles of everyday products, the class investigated topics like water, transportation, waste, and food. During the week devoted to food, students visited three supermarkets with different buying philosophies, and they came to the Reppun farm in Waiāhole valley, to see how food makes its way from the earth to the store shelf, and then into a mouth.

The students walked all over, sampling various fruits and checking out the more than seventy kinds of edible plants my brother Paul and I have stuck in the ground over the past thirty years, including corn, cacao, coffee, sweet potato, and taro. One boy said, "Gee, Mr. Charlie, there is a lot of food on your farm. So, how much is there?" "Well, knowing how much taro we get per square foot," I answered, "let's figure out how big this patch is and see how much we can get out of this lo'i." Evan proceeded to pace off the distances and Blaise did some quick mental math. "You can produce about 4,000 pounds of taro from just this one patch," he calculated. "How many people will that feed?"

Gradually a question emerged: could we feed everyone in the State with what is grown right here in these islands? Back in class the students went to work. Nutritionist and researcher Mae Isonaga from the Cancer Research Center of Hawai'i talked with the class about a person's nutritional needs—about 2,500 calories for the average adult male, with a variety of nutrients from across the USDA food pyramid. She helped the students come up with ingredients for a balanced diet for a single day. All the foods they picked had to be currently grown here—mustard cabbage, tomatoes, and papayas, for instance. The large bottom layer of the food pyramid consists of grains and other staples. Since wheat cannot be raised here, and rice is not currently

grown, the students picked the historic staples, taro and sweet potato, and added sweet corn. The teachers put the results into a spreadsheet so the students could keep track of the calories as well as other nutrients such as protein and calcium. After some negotiations, the one-day diet was completed.

The spreadsheet columns grew when the amount of food for a day was multiplied by 365 to find how much one person needs for a year. Then came the big leap: when we multiplied what a single resident requires by the approximate population of 1.3 million to find the yearly demand of each food for everyone in the islands on that contrived diet.

The students then turned to the internet to find online resources about land use in Hawai'i. The National Agricultural Statistics Service (NASS) collects data from every state about land area in production, and the number of pounds harvested for each crop. The number of pounds per acre was simple to calculate, and the students used the yield to derive the land needed to feed everyone in the state.

	DIET FOR A SINGLE PERSON			CURRENT PRODUCTION		DIET TO FEED EVERYONE	
	cups/day	calories	lbs/year	lbs per year (millions)	acres	lbs per year (millions)	acres
FRUIT							
papaya	2	180	225	28.7	1,530	293.0	15,618
banana	2	400	362	20.0	1,000	470.8	23,541
VEGGIES							
tomatoes	2	64	290	14.7	700	376.7	17,936
broccoli	1	30	71	0.3	60	92.1	16,740
mustard cabbage	2	40	274	1.4	115	355.7	29,221
lettuce	2	10	58	1.2	120	75.3	7,533
zucchini	1	29	145	1.1	175	188.3	29,961
GRAIN/STARCH							
corn	1	177	132	1.8	350	171.6	33,364
taro	2.5	467	266	4.5	380	345.3	29,156
sweet potato	1	220	125	6.0	360	162.2	9,730
MEAT/NUTS							
beef* (oz.)	6	402	137	36.0	1,198,000	177.7	5,913,461
mac nuts	0.5	481	54	65.0	15,000	70.1	16,177
TOTAL		2,500			1,217,790		6,142,440

Total without beef = 228,979

*current beef production based on all cattle in Hawai'i staying in Hawai'i

FRUITS AND VEGETABLES

They first checked out produce. For everyone to eat one cup of broccoli a day for a year would require just over 92 million pounds. We now produce about 300,000 pounds on sixty acres. That means we need 16,740 acres in broccoli for us to be self-sufficient on the diet chosen by the students. How about papayas? If, following the diet, we all ate two cups a day of papaya, we would need 15,618 acres to feed everyone, instead of the current 1,530 acres. For all the fruits and vegetables in our diet to feed us for a year, we would need more than 140,000 acres in tillage. Of course we grow many more kinds of produce than those in the students' diet, some 11,000 acres in all. So we would need more than twelve times the current produce acreage to be self-sufficient.

ARE WE ANY BETTER IN STARCH?

No. In fact, starch production and our current eating habits could very well be the area of food security where we are the most vulnerable. Most food we import is in the form of starch—bread, pasta, rice, cereal, chips, cookies. It's a long list that shows our love and craving for a wide variety of tastes and foods. One cup of sweet potatoes per day, per person, for a year would require just over 162 million pounds. We produce now about 6 million pounds on 360 acres. That means we need more than 9,700 acres in sweet potatoes for us to be self-sufficient on the diet chosen by the students. For taro, with 1.3 million people we would need 28,776 more acres than the current 380 in production.

THE MEAT/PROTEIN ISSUE

The students chose to include beef in their daily meal, because cows can be reared in pasture land, while every other animal here depends on imported feed. At the current animal per acre rate, if all of the cattle in Hawai'i were used for beef production, we'd need nearly 6 million acres to feed us each 6 ounces of beef a day. That's a bit steep, considering that there are only 4.1 million acres of land on all the islands. Of course, the 25 million pounds of fish caught in Hawaiian waters are an important protein resource, and if that catch is sustainable, the acreage needed for beef could be reduced to closer to 5.5 million acres.

BACK TO CLASS

The students then discussed their research about the benefits of self-sufficiency. Why should we grow our own food? Blaise provided the most obvious answer: "Simple. Then we wouldn't have to depend on the mainland." John added, "We can help reduce the amount of gas that is used from ships to bring food here by trying to grow more crops." Alec then made this point clear: "Because gas prices are high, shipping from a farm on the Big Island will use much less fuel than shipping from Mexico." Megan had found out that "four hundred gallons of oil are used each year to feed one American, and 31 percent of that oil is devoted to producing the chemical fertilizers so plants will grow better. We don't need to hurt the environment by using artificial fertilizer. We can use natural fertilizers like mulch, manure, or compost." Katie then pointed out that growing our own food "can help Hawai'i's economy because the profits on the produce will go right back to the people of Hawai'i instead of going to a corporation on the mainland."

Mika talked about the quality of what we eat: "Our produce would be fresher. We could just go to a store and buy a tasty fruit or vegetable that has not been sitting in a container for days or even weeks." Another student had her eye on diversifying our employment base: "Farming opens up more job possibilities for the unemployed in Hawai'i, and offering college students courses for this occupation would ensure farming a safe place in tomorrow's economy."

These students learned a lot more than how to weed a taro patch.

ARE THE STUDENTS RIGHT?

When cover crops that take nitrogen from the air and put it into the ground to be used by the next crop, and animals, with their manure, were part of farms, two calories of food energy were produced for every calorie of energy invested. After World War II, the use of synthetic nitrogen and the industrialization of agriculture began, and today it takes ten calories of fossil fuel energy to produce one calorie of food energy. Synthetic nitrogen is made from natural gas. Its price has more than tripled since 2002, and the United States imports more than half its nitrogen. As soils become depleted of organic matter, farmers need to apply more and more nitrogen.

And how does nitrogen "hurt the environment," as Megan asked? Much of the fertilizer applied to fields never reaches the plants, but instead either leaches through the soils, with large amounts ending up in the water, or is volatilized into the air as nitrous oxide. Farming is one of the biggest polluters of our water systems, and nitrous oxide is a greenhouse gas three hundred times more potent than carbon dioxide. So both the soil and the atmosphere would benefit from going back to the old system of manure, cover crops, and compost.

HOW MUCH DO WE LOVE FRESH PRODUCE?

Mika thought it would be great to eat fresher produce. How many fresh fruits and vegetables do we eat? The recommendation is seven to nine servings, although a diet deficient in fresh produce is now the norm across the United States. If all of what Hawai'i produces is added to what we ship in, then we are eating less than one pound of fresh produce a day, compared to the almost three pounds called for in the USDA food pyramid diet. So eating the amounts of produce in the students' diet means that we need twelve times more land. That is not true for starch, the base of the food pyramid. We would need twenty-seven times the current acreage for sweet potatoes, and seventy-seven times the current acreage for taro.

While America's consumption of beef has been dropping—76.6 pounds per person in 1980 to 66.1 in 2004—our total consumption of all meat had increased to about 200 pounds in 2004. This is tied to eating fewer fruits and vegetables, and is one of the reasons for the steep rise in numbers of overweight people—nearly half of all adult Americans (31 percent of adults meet the criteria for "obese," as do one in seven children). We are replacing fresh produce with calories from more meat and starch.

WHO WILL FARM?

Finally, what about Megan's comments about farming as an employment opportunity? We are constantly reevaluating the ways that we work, trying to create a more sustainable farm. That work is, as Paul Roberts, author of *The End of Food* says, both intellectually intensive and labor intensive, which makes farming mentally and physically healthy.

Yet there are barriers to recruiting a new generation of farmers. Countless variables present daily challenges—especially the weather. Living on the farm helps farmers save money and keep tools, supplies, and crops secure, but many farmers cannot live on their leased agricultural land. Theft and vandalism in Hawai'i cost farmers 8 percent of their income in 2004. Nor, in our acquisitive society, is growing food lucrative: the 7,500 hired farm workers in Hawai'i earn on average only $25,094, and many farms rely on unpaid family members (there were over 1,100 non-paid agricultural workers in Hawai'i in 2002). That won't attract young people interested in material goods—not to mention needing to pay rent and buy health insurance. So, if Hawai'i wants to take significant steps towards food security, who and how many of us are going to need to grow food?

WHERE ARE WE GOING?

Those children came up to the farm almost two years ago, but globally not much has changed. Global warming from nitrous oxide, the continued heavy use of herbicides and pesticides, especially in foreign countries, that make farm work one of the most dangerous occupations—these and other external costs don't show up in the price of food. In 1929, Americans spent 23.4 percent of their income on food. Now it's just 9.8 percent. The world still eats mostly the four super crops—wheat, corn, rice, and soybeans—and animals consume one-third of production. Of course, we must have our sugar—about 100 pounds per person a year—and oil is still cheap enough that food can be shipped all over the world, helping poorer countries displace subsistence farmers with monoculture so that produce can be sold to high-end customers in high-end nations. This is also why a nation like Brazil is clearing 8,000 square miles of forest a year.

Does it make sense to pursue self-sufficiency in our island home? All of this information indicates that we must. Nainoa Thompson often talks about Hawai'i as a model for the world. When people finally realize that planet earth is a closed system, our "island mentality" can inform all. If the world is made up of many "islands," each "island" is in trouble when the food production and distribution systems they rely on are unsustainable.

Clearly, our global and local diets need to change, and that won't be easy, since the problem foods, high in fat and sugar, are also what we crave and love. The advantages to making the changes that the students came up with are enticing, and even compelling, and the journey in the direction of sustainable, self-sufficient agriculture, though fraught with difficulties, can be taken in small steps that will produce positive results immediately.

Organizations focusing on diet change and food security are springing up everywhere. There are more and more school and backyard gardens, which may provide one of the most important answers to the questions of who will farm, and how. We need to get good affordable food to lower-income families. We need to reduce synthetic nitrogen use, mitigate the external costs of conventional agriculture, and improve soils by using more organic matter. None of these will raise farmers' profits; in fact, they all translate into more labor. So maybe it doesn't work to have 1.6 percent of the population of Hawai'i doing agricultural production, and it doesn't work to keep bringing in poor people from other nations to do the work. Maybe we need to see how much of an agrarian society we can become again. That might just be possible in backyards, schools, and community gardens. Maybe building permits

could be contingent upon putting in garden spaces. Maybe tax breaks could be given for gardens as well as for solar energy. After all, America now has 25 million acres of lawns. Green waste, now available at only a few sites, could be made available in every community. Many backyards could accommodate chicken-tractors and fish ponds—of course, restoration of some of the very productive historic Hawaiian fishponds has been underway for years. What about a fast-food restaurant chain with only local food? Healthcare providers could discount premiums based on steady weight reduction.

These are not really new ideas. Many have been tried before, but never before has the urgency to act been so great. The first people of Hawai'i took advantage of a very rich ecosystem, much of which remains. Their methods particularly suited to this ecosystem for cultivating an older brother who fed them well are legendary, but the older brother has been largely absent from most people's lives for too long. All of us who live here could benefit by his resurgence. Think Globally, Act Locally.

And just so there's some fun in this:

A (Healthy) Fast Food Recipe

wash a raw sweet potato, don't peel

grate it with a cheese grater

add raw egg

add chopped green onion, and or anything else, salt and pepper, and curry powder if you like

form into a patty, pan fry in olive oil

optional: add a piece of cheese on top, put lid on to melt it

total time to prepare: less than 15 minutes