Applied Geography for Sustainable Living

# Eye on the World

**Apr 2024, Vol 6 No. 3**



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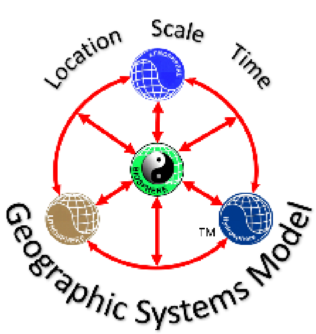
Geography may not change the world, but it will change how you see it.

## *Why Geographers Should Get Into Disaster Management*

In 1963, three American sociologists, E.L. Quarantelli, Russell Dynes, and Eugene Haas founded the Disaster Research Center. They asserted the obvious, disaster studies and government research lacked the involvement of sociologists and social scientists. Disasters, like any term or concept, are human constructs. As such, it should be obvious they cannot exist without humans. For example, a massive landslide in an uninhabited location is not deemed a disaster. A landslide that injures or kills people and/or damages or destroys property is considered a disaster. Ironically, after more than six decades, there is no universally accepted operative definition of disaster across all disciplines and administrative agencies.

While this may seem confusing, just think of many commonly used words in daily life. A related term to disaster is emergency. Ask folks on the street, family, friends, and co-workers to define the term without using any reference source. The results tend to be a general "sense" of what it is. All the various colloquial "definitions" share a common thread but have nuanced variations. Few folks may know the legal definitions that can vary from federal to state laws, policies, and regulations.
Even at a less serious and legal level, the common English word "sort" is not necessarily universally or easily understood. Imagine a new employee is assigned to a previously occupied office. They are told to make themselves at home, but to sort through the desk and filing cabinets. They can keep what they want and return the rest to the receptionist. What do you expect to see: 1) a person opening up all the drawers and picking things to keep and things to take the receptionist, 2) a person emptying all of the drawers, arranging all of the contents in either alphabetic or numerical categories in either ascending or descending order, then making their selections and returning the rest to the receptionist. In reality, both are possible correct interpretations and implementation of the. instructions, but the operative definitions come from different fields.



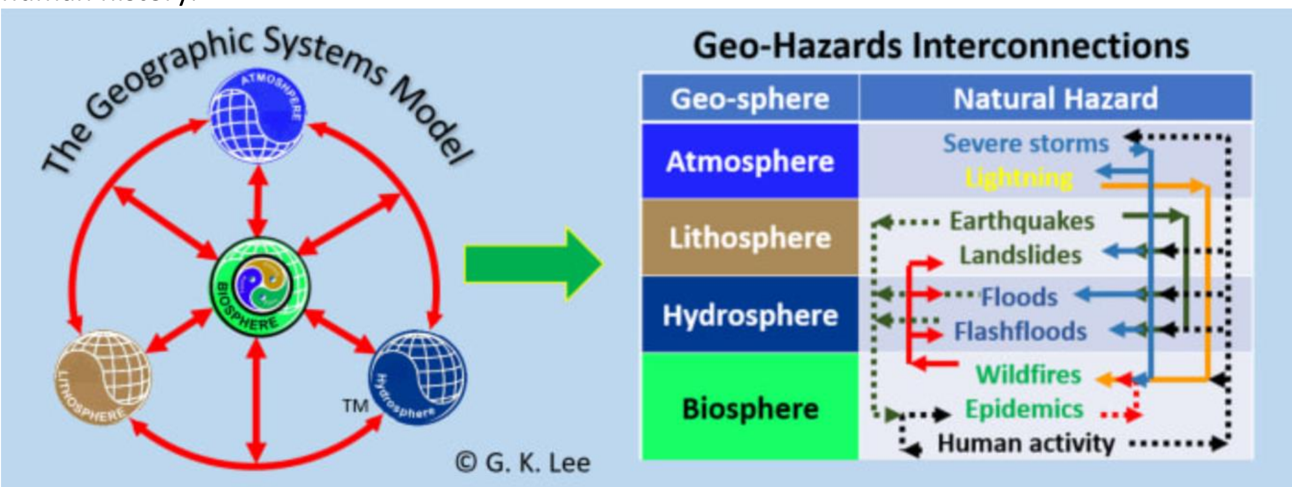

**What does this have to do with geography and geographers?**

First, the geographic systems model (GSM) is an inclusive, holistic, interactive model capable of synergy. It simultaneously integrates all life, physical, and social sciences to study the Earth's phenomena at any location (e.g., place), scale (size or geographical extent, or level of detail), and any period (e.g., past, present, and projected into the future). Second, it provides the context for these studies relative to the rest of the world. Third, the GSM helps to find connections between the environmental

**In This Issue**

spheres, disciplines, organizations, people, and more. Fourth, the GSM stimulates and encourages transdisciplinary collaboration.

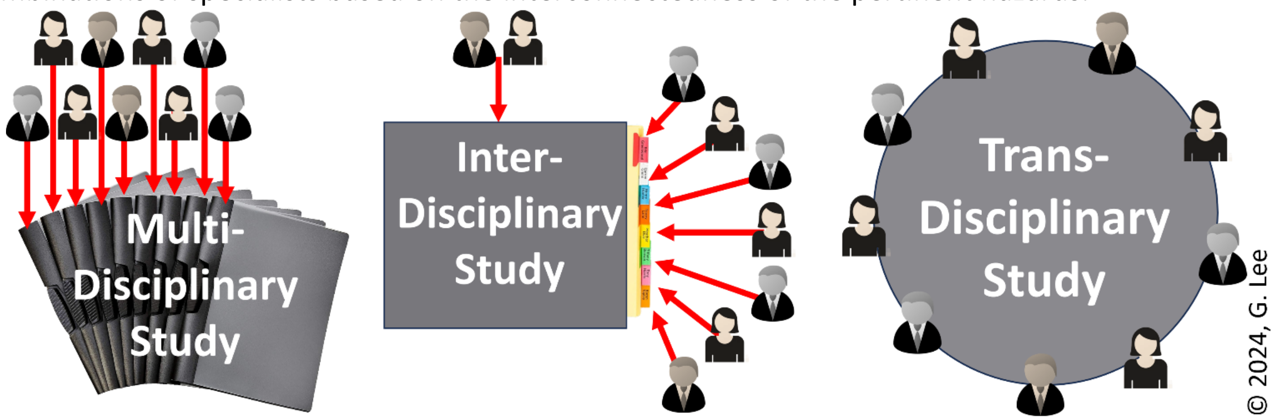
The diagram below shows the relationship of the GSM to a selected array of geo-hazards and their possible interconnections. The left part of the diagram shows the GSM; the geographic concepts of Location, Scale, and Time; the four environmental spheres, and arrows suggesting the possible pathways for the movement of matter, energy, and processes in the system. The GSM is a visual cue to guide systematic overviews of an issue simply because the vast majority of human activity takes place on Earth. Geographic Information Systems (GIS) draw on databases that store data with a geo-location tag along with chronological data. Global Position System (GPS) navigation technology permits more precise geo-location than before. Combined with Remote Sensing Technology, unparalleled data acquisition enables national and regional mapping capabilities greater than ever in human history.




The actual interconnectedness of hazards depends on their location, scale, and time. The potential for a disaster depends on the juxtaposition of the hazard with the presence of people and a triggering event (e.g., a storm, volcanic eruption, technical or industrial accident, etc.). [**Note**: Culture shapes environmental perceptions and determines what people consider a hazard. FFI: See 1, 2.]

In the past multi- or cross-disciplinary disaster studies suggested the collaboration of several different experts, but the practice was not fully integrated (but without sociologists). Experts from various disciplines might have been working on the same project, but their reports tended to be viewed as separate chapters or reports. Interdisciplinary studies strove to harmonize the different reports into a coherent whole. Transdisciplinary studies require interactive collaboration to produce project reports that can be synergistic.] This is a better fit for studying the increasing complexities of the Anthropocene.

The right side of the diagram above shows the association of the environmental spheres to selected geo-hazards and examples of the interconnectivity of different geo-hazards. For example, an earthquake can trigger a significant disaster affecting people and property. Earthquake energy can also trigger landslides. A landslide can create an earthen dam in a river. When the earthen dam is breached it can create a flash flood. Farther downstream the flash flood reaching open terrain with a lower gradient could appear as a flood to those unaware of the original flash flood. The secondary or cascading impacts are indicated by the arrows on the right side of the diagram. Further complexities can emerge from multiple disasters (where an earthquake triggers multiple landsides), or cascading events that destroy vegetative land cover creating situations of increased flash floods, floods, and landslides. Geographers are uniquely empowered to get the "big picture" holistic overview using GPS, RS, and GIS technologies. While other disciplines can utilize these technologies without geographers, the geography discipline often integrates across discipline lines. In a multi-disciplinary study, earthquakes might be the focus of geologists and geophysicists working with engineers on landslides, floods, and flash floods. The final report might appear to be a single document with each specialty written up as separate chapters. An Interdisciplinary report would link the separate reports together to read more seamlessly as a coherent report in contrast to a segmented multi-disciplinary report. A transdisciplinary report would be a holistic document with sections written collaboratively by combinations of specialists based on the interconnectedness of the pertinent hazards.




The eclectic nature of geography is a convergent discipline of all life, physical, and social sciences and the geo-technologies (e.g., RS, GPS, and GIS). It is inherently open to include all sources and perspectives of knowledge from diverse cultures. Traditionally, the academic discipline of geography is a triad of physical geography, cultural/regional geography, and techniques (e.g., cartography, aerial photo interpretation, RS, GPS, and GIS). Undergraduate geography majors are exposed to the basic triad. Graduate majors tend to specialize within one of the segments of the triad. Undergraduates and graduates are prime candidates for advanced studies in emergency and disaster management.

Geographers have a sense of appreciation for the significance of Place and its fundamental role in describing culture which shapes individual and collective perceptions. Just as all hazards are not created equal, all hazards are not perceived equally. The dominance of Western science is pervasive and many hazards, threats, risks, preventions, mitigations, responses, and recoveries are framed in that cultural perspective. However, the past disappointments of the global imposition of Western science (e.g., the Atomic Age of the mid-1950s to the present, the Green Revolution of the 1960s, the industrial disasters such as Bhopal, Chornobyl, Valdez Oil Spill, the Fukushima Nuclear disaster, the catastrophic wildfires), have called into question the credibility of science, technology, and scientists. The confusion of the climate change issue is a case in point regarding the limited understanding of science by policymakers and the general public.

With the geographic holistic big-picture perspective, geographers are prime candidates to be facilitators and coordinators of complex transdisciplinary projects such as emergency and disaster management. Natural phenomena have little to no respect for International, national, regional, and geopolitical boundaries. Disasters can impact the rich and the poor, the famous and the common, and can produce synergistic outputs (both good and not-so-good). No matter how technologically advanced a nation or a society may be, a disaster can reduce it to third-world conditions in minutes. As the COVID pandemic showed, international supply chains can be critical to survival. Geographers can and should be at the forefront of emergency and disaster management.

# *The Dark Side of Green*

GREEN

All the hype about going green fails to mention the dark side of all the clean green energy technology: They are all produced using fossil fuels from the extraction of raw materials, transportation from the source region to the processing/manufacturing centers and then to the consumer markets. In addition to the raw material extraction, vast amounts of fossil fuel and water are consumed (not to mention the wastes produced in solid, liquid, and gaseous forms polluting the environment). Homeowners with solar panels may take pride in their “clean-green power” but only if they ignore the huge carbon footprint used to make all the components for their home solar system.


Photo from Freepix

The first step in making solar panels is finding high silica sand (1, 2). Prime source regions are Australia and Brazil. Fossil fuels are used in the mining, cleaning, and transporting the sand to China (a major maker of silica wafers to solar cells). Making a 2-foot wide silica wafer for solar panels uses 16,656 L of water.

The disposal of used solar panels has yet to be fully determined. Recycling costs are high causing many used solar panels to end up in landfills. The lack of policies and regulations on the proper disposal of used solar panels leaves a potential ogre lurking in the shadows.

Electric vehicles appear to be clean and green but the hidden dark side is in the fossil fuel footprint of the raw materials, processing, transportation to market, source of electricity for using the vehicle, and the unknown disposal of the vehicle after its useful life. During its lifetime, maintenance materials and the cost to produce them rely (wholly or partially) on fossil fuels. The dependency on fossil fuels is dictated by the monetized economy.

When money is the primary valuation system, all other perspectives are diminished, ignored, or don’t count at all. The quality of life factors are often non-quantifiable, subjective, and not readily standardized among people and cultures. Environmental factors are hard to quantify partly because they are not fully understood, and the complexities of natural systems are not easily put into a monetary context. Regardless of the technology used, there are only four places on Earth where wastes can go: the air, land, water, and living organisms. The primary action people can take is to reduce consumption and waste. Reduce and eliminate the use of plastic as much as possible. For example, pass up on “soft soaps” in plastic bottles for “old fashioned” bar soap. Minimize your carbon footprint by conserving electricity and reducing driving. Begin to explore alternative economic practices (e.g., cooperative housing and time banking. These are all actions you can do today.

# *Climate Change Crop Alternatives*

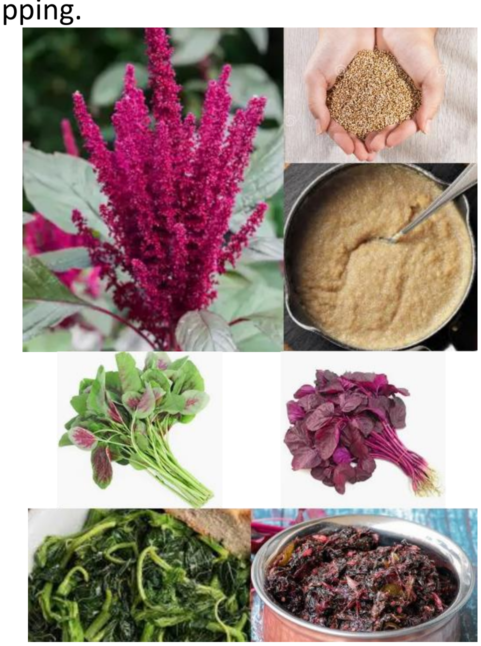

Earth icon adapted from original by Muhammad_Usman

Global warming and increased drought frequency and duration are driving concerns about food security and searches for alternative crops. For farmers, the preference is for drought-resistant vs. drought-tolerant crops. The former can survive prolonged periods without water. The latter can survive a short time (e.g., a few days or weeks) with limited water.

When introducing different or unfamiliar food crops, systematically consider the physical environment (e.g., climate, soils, compatibility with native flora/fauna, especially pollinators, to avoid introducing an invasive species) and the cultural/social environment (e.g., farming methods, tools, eating habits, cooking methods/utensils). If climate conditions permit, introduce solar cooking methods to supplement existing methods to reduce fuel consumption and reduce the local carbon footprint.

An ideal new food crop should have as much (if not more) nutrient value as the crop it is replacing, fit with local dietary preferences, and agricultural practices, be drought resistant, survive in poor soils, require minimal care (e.g., watering and weeding), be perennial, not be hybridized or be limited to commercial seed sources, have characteristics that add to soil erosion management capabilities. While few, if any plants, might possess all these traits, remember, this is an "ideal" list. We advocate no-till, no burning, composting/mulching, crop rotation, bio-diverse cropping, and integrated pest management favoring native species.

In this list of three crops, the biggest obstacle may be the unfamiliarity of what it is and how to prepare and eat it relative to existing diets. All of these were widely used in earlier history in their native ranges. Impoverished people tended to continue growing and eating these crops because many had been replaced by corn, wheat, rice, barley, oats, and rye. Traditional subsistence agriculture tends to be more bio-diverse than commercial monoculture for cash cropping.



**Amaranth (*Amaranthus spp*.)** is found in Africa, Asia, and the Americas. It is an annual or short-term perennial that is drought and saline-tolerant. Water is needed during critical growth stages. Root depth ranges from 46 cm-92 cm; its tap root can reach a depth of 1.5 m.  In some cultures, the leaves and seeds are eaten(e.g., *Amaranthus spp. (A.cruentus, A.dubius, A spinosus, A tricolor, A.caudatus)*, while in others only the seeds are consumed. It can be grown from 0 to 2,400 m elevation, with species adapted to 22-30°C (min. 15-17°C for germination). Irrigation may be needed in the dry season due to the plant's transpiration characteristics. Once established in low to medium humidity. loam or silty-loam soils with good water-retention capacity with pH from 4.5 to 8. It can grow in a wide range of soil types and soil moisture levels and can tolerate poor soil but yields may be lower. Amaranth's seeds are rich in beta-sitosterol and other phytosterols. Its seeds are high in manganese, calcium, iron, vitamins A, and B. [**Note**: Although an annual, some people periodically collect seeds and re-sow planted areas every two weeks thus ensuring a year-round crop and food supply.]

**Fonio:** White fonio, *Digitaria exilis*, is an annual grass native to the dry savannas of sub-Saharan Africa (the Sahel). It grows in light, sandy soils, in areas with 900 and 1000 mm average precipitation, and 25 and 30°C. It is drought-resistant with a root depth of 1 m. Traditionally planted in rotation with rice, sorghum, or millet. Growing requires little to no input and maintenance. But its tiny seeds are labor intensive in threshing and preparation. Fonio is high in Thiamine (vitamin B1) and B-complex vitamins. It has calcium, iron, copper, zinc, and magnesium. Protein and fiber are considered moderate, but fonio is high in essential amino acids. People consider this food for the poor, so it has a low social status. Native people who depend on it see it as the seed of the universe as it is key to their survival. It is being introduced to the US by Chef Pierre Thiam.

**Cowpea, *Vigna unguiculata***, is an extremely drought-resistant, heat-tolerant, annual plant, needing little or no irrigation once its deep taproot system (about 2 m or more) is established. It should be planted after the last frost when the soil temperature has reached 18.3°C. Avoid alkaline soils, but any other soil type is usable (acidic to pH4) so long as they are well-drained. Ideally, plant in sandy loam, pH 5.5-6.5 in full sunlight. It prefers hot, moist conditions., it is native to the Americas and Africa. It grows fast and covers the ground, suppressing weeds to reduce labor. If planting in rows, remove weeds appearing between rows or heavily mulch between the rows. No fertilizer inputs are needed. Seeds and pods can be eaten raw. The leaves can be cooked as a vegetable. Dried seeds are cooked for eating. The cowpea is high in dietary fiber, protein, iron, and magnesium and has the amino acid tryptophan.

# ***More Information About Soils***

In addition to climate change, farmers must contend with changes in soil conditions and the persistent threat of soil erosion. Systematic soil monitoring and management are practical actions farmers can do on the farm with little to no added money spent.

| W.O.R.M.S. | Geographic Systems Model |
| --- | --- |
| **G.R.O.W.** Getting Real On-Farm Weather | **Atmosphere (Air)** Rain = Amount, wind, storms; Sunlight = Heat, amount, angle |
| **S.O.S.** Save Our Soil | **Lithosphere (Land)** Soil = Type, quality; Slope = Angle, aspect, length; Erosion = Condition, amount |
| **S.O.W.** Save Our Water | **Hydrosphere (Water)** Water; Surface sources; Subsurface sources |
| **C.O.M.P.O.S.T.** Creating Our Most Precious Organic Soil Treatment | **Biosphere (Living Organisms** Flora = Natural vegetation, crops; Fauna = Livestock, wildlife; People = Customs, economy |

AppGeog created a holistic soil management program, Working on Restoring and Making Soil (WORMS). Using the geographic systems model (GSM), WORMS has four major sections, each tied to a dominant environmental sphere (see table on the right). Getting Real On-farm Weather (GROW) is important to monitor local climate change and record rainfall patterns. This aids in rainwater harvesting and monitoring soil erosion. Save Our Soil (SOS) is a five-part series covering erosion detection, slope measurement, erosion reduction, and soil testing (SOS 4, 5). Some farmers may experience water shortages. The Save Our Water (SOW) provides farmers with water storage and conservation information. Creating Our Most Precious Organic Soil Treatment (COMPOST) teaches farmers why and how to make and use it.

# *Opportunities for Improving Education and the Local Economy*

Since WWII, international financial and non-governmental institutions have touted education programs to alleviate poverty. To date, these have failed miserably as many African, Latin American, and South/Southeast Asian nations are more impoverished than when the programs began. A critical shortfall was the lack of access to jobs.

All WORMS training activities are readily adapted to all education levels with or without formal school infrastructure. The goals are to improve education to produce the next generation of environmental stewards and empower people to create local cottage industries to sustain their community. AppGeog uses its community-based education (C-bE) method to create practical applied lessons (PAL) linking academics to practical job knowledge and skills (C-bE, pp. 11-12). Students gain practical job experience by making and using the equipment for their training based on the enhanced STEAMING model (an enhancement of STEM/STEAM curricular methods) and community service. projects.

This approach was proposed for the Rural Training Center-Thailand's Independent Fuel Systems (IFS) example, for energy self-sufficiency for small family farms (see proposed program schematic on the next page). School math and science lessons set the foundation for bio-gas digesters and on-farm biodiesel fuel production using *Japtropa curcas* (an oil seed crop capable of growth in poor soils unsuitable for food crops and using little water). Processing can be done manually without caustic chemicals and special equipment/training.

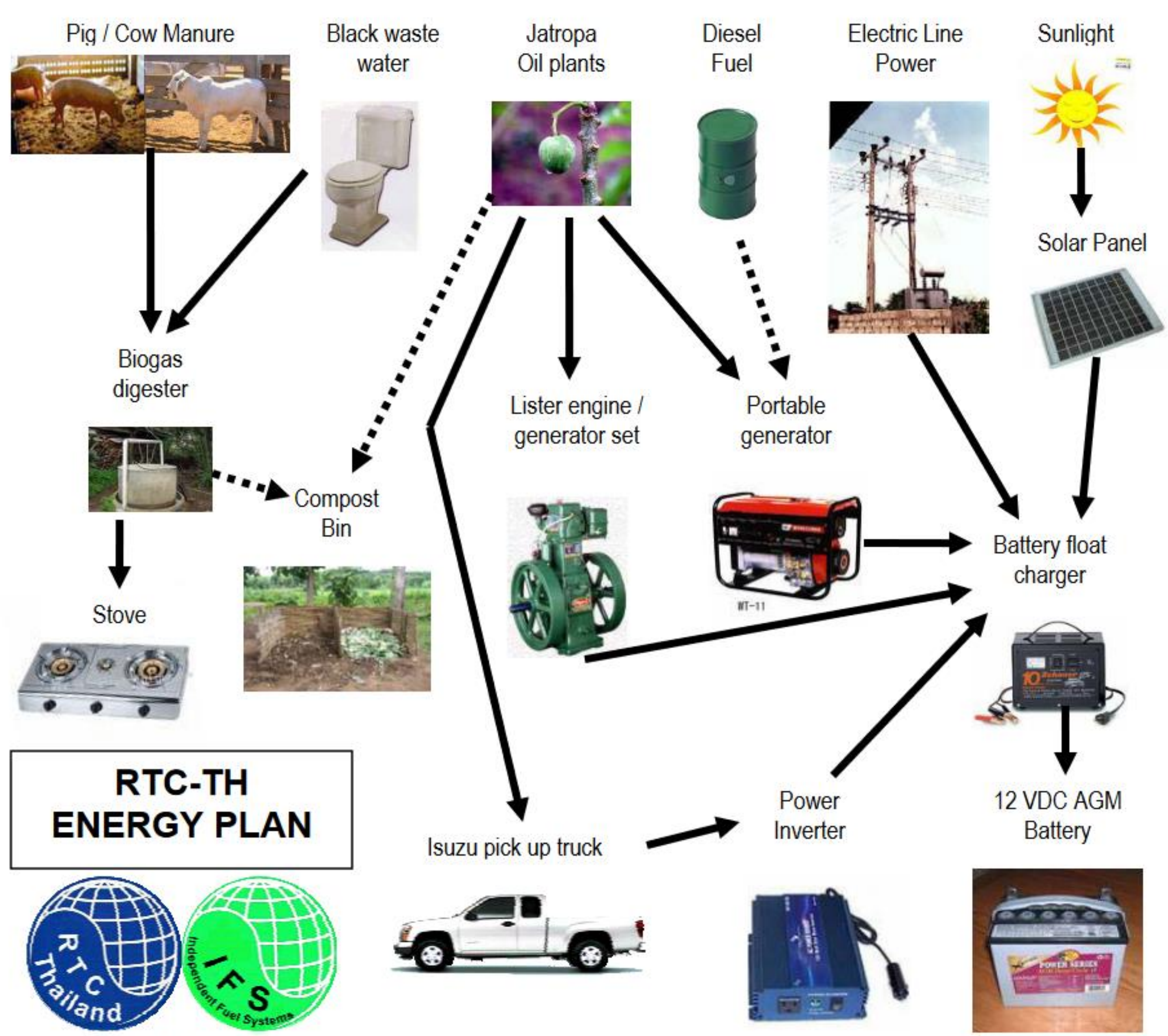
Biogas can be used for cooking to replace wood and charcoal cooking fuels. This reduces deforestation and the carbon footprint for cooking family meals. *J. curcas* biodiesel runs low-speed, low-compression diesel engines found on walk-behind tractors) or easily modified existing diesel pick-up truck engines. Building biogas digesters and *J. curcas* cultivation, harvesting, and processing can all be practical lessons students can use to start small businesses. These businesses have a ready accessible local market to help build and sustain the local economy.

*J. curcas* biodiesel fuel production could become a village enterprise creating jobs and marketing to others for additional revenue. It can be planted in uncultivated land (e.g., public road rights-of-way, property boundaries). Harvesting can be a communal activity with the biodiesel going to a community generator at a village power station. J. curcas biodiesel is cleaner burning than fossil diesel fuel. Thus, *J. Curcas* biodiesel helps reduce pollution and lowers a village's carbon footprint.

The *J. curcas* biodiesel-powered village electricity generation can be a way to decentralize the power grid, create local jobs, and give villages resilience in disasters. The infrastructure cost savings can be significant by having remote villages off of the centralized power grid. There can be huge savings in the cost of the distribution grid installation and maintenance. The reduction in the distribution lines can also reduce the risk of wildfires due to downed power lines.]

## Summary

A holistic C-bE that prepares students to apply their knowledge to practical use in community sustainability and resilience can also contribute to local economic development. Past efforts using education for poverty alleviation were segmented and not linked to local jobs. Effective poverty alleviation can occur when more foresight and pragmatism in educating people with a purpose to build stronger communities.






## Rural Training Center-Thailand Energy Plan

The general energy plan for the RTC-TH is a practical implementation of the IFS (Independent Fuel Systems) and our overall goal for self-sufficiency and sustainability for small rural family farms.

- **Biogas**: reduces animal wastes and possible water pollution; produces cooking gas and residue is clean compost.
- ***Jatropa curcas***: produces SVO (straight vegetable oil) fuel for all diesel engines on the farm.
- **Fossil Diesel & Electrical power**: Minimal use with an eye to reduce consumption of these to zero.
- **Generators**: to produce our own electricity; has the potential to generate revenue by selling power to EGAT.
- **Solar PV Panel**: small demonstration unit for battery charging.
- **Truck**: can be used to provide battery charging when driving long distances.
- **Battery / Batteries:** Work carts can be used to move batteries / tools to work site. Provides emergency portability for radios and other power tools.
- **Compost**: Biogas generator and Jatropa residues are composted for farm use.