

ORIGINAL ARTICLE

Community-based solutions to locally-sourced food production systems featuring the revival of indigenous knowledge

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Abstract – Gaia Education (GE) - an international NGO with headquarters in Scotland - has been pioneering community-based educational approaches to sustainable design and development. Founded concurrently with the launching of the UN Decade of Education for Sustainable Development (UN DESD) 2005-2014, GE has been developing unique curricula and pedagogy drawn from the precedent of the educational experiences of eco-village models around the globe. With a 10-year track record in forty-three countries on five continents, GE programmes are conducted in settings ranging from tribal and traditional communities to intentional eco-communities, from urban slums to universities and R&D centers. GE educational programmes equip students of all ages and cultural backgrounds with the appropriate knowledge, skills, and critical thinking tools necessary to design a society which uses energy and resources with greater efficiency, distributes wealth equitably, centers autonomy within local communities, and makes quality of life, rather than open-ended economic growth, the focus of future thinking. Learners become change agents capable of playing active roles in transitioning their existing communities and neighbourhoods to sustainable and regenerative practices, lifestyles and infrastructures.

The starting point for this paper is concern about the impactful effects of industrial food systems, based on large-scale, energy and resource-intensive, agribusiness enterprises operating at a global scale. In this context the paper introduces and analyses a series of regional Project-Based learning initiatives taking place in the Global South, developed within the framework of UN Sustainable Development Goals that address the standard three dimensions of sustainability - environment, society, and economy -with culture added as a unifying fourth dimension. These capacity building projects conducted with partners in Bangladesh, Senegal, India and Sicily support communities to transition from the input-intensive agriculture introduced by forces of globalisation to locally-sourced, agroecological food production systems featuring the revival of indigenous knowledge and cultural traditions. In this process, regenerative whole systems design practices developed in the North are introduced to villagers in the South to complement and augment indigenous knowledge and cultural traditions in an effort to achieve food sovereignty and ameliorate the damage done to ecosystems by climate change. The GE model engages local communities in the spirit of participatory action research, working together to find low energy, low cost, creative and innovative solutions to local problems. The GE model uses a holistic, non-reductionist approach to education, weaving together social, ecological, economic, and cultural dynamics to produce a living synthesis that can result in long-term ecosystem and community health and well-being.

The paper concludes by examining how GE programmes create learning environments for villagers in climate-vulnerable regions that foster meaningful, actionable knowledge. This knowledge promotes food sovereignty through the sustainable potential of community-based, locally-sourced food production systems, featuring the linkages of social, ecological, and cultural dynamics.

Keywords – locally-sourced food, indigenous knowledge, Gaia Education, agroecological food production

Context: A brief history of food production systems

For the vast majority of their existence, human beings lived as “hunter-gatherers.” This lifestyle saw human beings assembled together in relatively small, clan-size socioeconomic units of 25 persons or so (Leakey, 1994). These groups followed the migration of game animals, synchronized with the maturing and fruiting of desirable plant foods at successive times and/or elevations. This lifestyle could be considered “sustainable,” that is, “capable of being continued into the indefinite future” (Gilman, 1991). What made it sustainable was that the lives of these people were intimately integrated into the cycles and seasons, the ebbs and flows, of Nature. The people had a detailed, functional, *encyclopedic* knowledge of the flora and fauna of their home range.

In due time, however, hunter-gatherer lifestyles transitioned into what is known as the Agricultural Revolution, characterized by a shift to sedentary, village-based lifestyles with tilled-and-cropped food production systems. It is generally assumed that the transition to agriculture was an obvious improvement over hunting-gathering; yet, analysts like Kotke (2007) estimate that the transition to agriculture doubled the annual workload and resulted in depleted nutrition. Perhaps, then, the prevailing story is backward? What if the population increase happened first, and then village-based agriculture was adopted as an adaptive response to over-harvested and thus deteriorated ecosystems?

This possibility becomes even more compelling when considering the next step in cultural evolution: the transition to *civilization*, or the culture of cities. A civilized lifestyle requires another doubling of the annual workload coincident with further depleted nutrition. Schmookler (1984) provides a scathing critique of “civilization,” observing that this culture is characterized historically by rigid social hierarchies, the relentless centralization of arbitrary power, and the ongoing devastation of Nature. Of course, it is the culmination of the 5000-year march of civilization that we are witnessing today with the rise and entrenchment of the tenuous global economy. This is a *macro*-economy, characterized by corporate centers wielding techno-industrial prowess, and sourced by supply lines stretching across every continent. And what is the state of food production systems amid this hyper-complex and hyper-strained global infrastructure? Here is a conclusion reached by agronomists from University of California at Davis:

Indeed, if our planet were a bank, disbursing loans of natural resources, agriculture would be among its biggest debtors. Each year, agricultural practices erode mountains worth of topsoil, drain continents of their groundwater reserves, and eliminate plant genetic material in what is essentially colossal resource borrowing from future generations. Because today's farming uses many renewable resources at well beyond their rate of replenishment, and because little effort is

made to replace them, agricultural resource debts continue to mount. The borrowing, however, cannot continue indefinitely. As this century commences, clear signs of lender fatigue are evident: five decades of resource over-exploitation have drained reserves of natural capital in many regions, and have limited agriculture's opportunities for future growth and resource borrowing. (Malkina-Pykh and Pykh, 2003, p. 301)

There seems to be much cause for concern; yet, the authors of this report did not yet mention the serious implications of the profligate use of *non*-renewable resources in industrial agricultural production. The reference here is to absolute dependence on fossil fuels at every stage of the process: petroleum is the base for pesticides and herbicides, natural gas is the source of nitrogenized fertilizers, gasoline is used to fuel the behemoth farm machinery and the massive inter-continental distribution systems; then there is all the packaging material and factory operations and research facilities. It is estimated that it now takes 10 calories of energy to produce 1 calorie of food - a 10:1 deficit that is hardly sustainable (Lott, 2011). Compare this with village-based, agroecological systems where 10 times more food energy is obtained than physical energy expended - a net energy *surplus* (Altieri, 2012).

Clearly, a review of food production systems over time reveals a steady increase in energy investment coupled with a steady intensification of centralized control. As food production systems have become progressively more resource-intensive, culminating in the modern phenomenon of transnational corporate agribusiness, food security has become progressively compromised and removed from local community management. As the 21st century proceeds, therefore, with projections of ever-increasing renewable and non-renewable resource depletion, food production systems that may foster real sovereignty must explore bioregional, community-based, locally-sourced solutions. Within this context, the revival of indigenous knowledge within village-scale dominions provides the surest strategy for long-term sustainability.

The holistic approach of Gaia Education

[A]ny definitions of sustainability are time- and place-specific. As situations and conditions change, so must our constructions of sustainability also change. Sustainable agriculture is, therefore, not simply an imposed model or package. It must become a process for learning and perpetual novelty. ~ Jules Pretty

Gaia Education springs from the restless, forward-thinking, ongoing hopeful inquiry of the world's “eco-villages” as living laboratories of integrated sustainability. Eco-villages offer widely applicable insights for the planning and reorganisation of our communities, neighbourhoods, cities, towns and societies in both rural and urban contexts. Over the decades these intentional communities have become research and development centers of carbon-constrained lifestyles,

wherein all the dimensions of sustainability - ecological, social, economic, and cultural - can be tested, practiced, and synergized together through principles of integrative whole systems design. As models of sustainable community, the eco-villages are inherently educational sites.

The founding purpose of Gaia Education was to gather and research all the various educational experiences to be found in these models and then to consolidate them into a standardized curriculum, with a flexible pedagogy that relies on participatory living and learning. Gaia Education, therefore, exemplifies a *holistic* approach that transforms learners into change agents with the capacity for leadership roles in positioning their projects and communities on the path toward regenerative self-determination.

Over time an affinity has been realized between the experiences of eco-villages in the North and traditional villages in the South. Some of the qualities and characteristics that these two settlement types have in common are (derived from Critchfield, 1983, 1994):

- Grounded in place, with each village being an anthropomorphic outgrowth of its particular setting and ecology - to the point of even wanting to *enhance* this unique, place-based identity.
- Strong social ties with an emphasis on egalitarian relationships, autonomy and self-governance, inter-generational cross-fertilization, and collective decision-making processes.
- Time- and place-specific economic strategies that ultimately rely on healthy encompassing environments, utilizing encyclopedic knowledge of local flora and fauna to service the needs of the community, and in every case relying on productive soils as the economic base.
- There is a common village culture, emphasizing qualities of accountability and collective responsibility, distrustful of globalising institutions, and embodying a stalwart self-reliance that values sovereignty and self-determination.

Since Gaia Education developed its holistic, multi-dimensional, community-based educational approach in the living and learning laboratories of ecological villages in the North, it is therefore superbly situated to attune with the educational temperaments of traditional villagers in the South. For instance, it is perfectly natural for a GE education team to sit in a circle with the villagers, having an egalitarian, mutually-productive discussion instead of standing at the front of the room delivering what Freire (1970) calls the “banking” model of education, where educators make a “deposit” into the learner’s account. Some of the methods utilized include vision-building exercises such as futures workshops, scenario analyses, utopian/dystopian story-telling, fore and back-casting, and collaborative real-world tasks such as service-learning projects. These approaches are perfectly natural for a GE team because they are precisely the sort interactive, participatory, egalitarian approaches that have

been developed over many years in their eco-villages of origin.

Participatory approaches have begun to attract the attention of sustainable agriculture professionals: “Participatory research has emerged as a powerful tool to identify agro-ecosystem indicators in developing countries. Indigenous knowledge thus generated complements scientific information to the benefit of all stakeholders (Goma *et al.*, 2001, p. 179). In this context villagers own their own research process; after all, they are the ones with intimate knowledge of local conditions. Imported techno-industrial “experts” have no place in this process. Sustainable agriculture is not, as Pretty noted, “an imposed model or package;” it is, rather, “an approach to learning about the world” (Pretty, 1995, p. 1250) – the *local* world, the everyday lifeworld in which villagers conduct their lives.

This paper will now focus on four Case Studies in which Gaia Education has introduced its holistic approach to facilitate Project-Based learning with partners in the South.

Case studies

Case Study 1

Country: Bangladesh

Name: Building Capacity & Empowering Communities in Khulna & Bagerhat Districts, Southern Bangladesh, towards Sustainable Agriculture, Aquaculture Development and Climate Change Adaptation Interventions

Period: 1 June 2013 to 31 March 2017

Funded: Scottish Government

Problem

Bangladesh is one of the most climate vulnerable countries in the world. The low-lying coastal districts of Khulna and Bagerhat are particularly vulnerable. Cyclones, tidal surge, and extreme flooding have devastated agriculture and food production, increasing mortality rates and destroying the livelihoods of many communities. More than 23% of the families in the region suffer from a shortage of food, with approximately 11% of community members unable to eat two meals a day (World Food Programme, 2007). In this region over 50% of agricultural land is affected by salinity caused by tidal flooding during the wet season and upward movement of saline ground water during the dry season. With very low organic matter content in the soils, communities struggle to get the yields necessary for their food security and livelihoods.

Approach

In 2013 Bangladesh Association of Sustainable Development (BASD), Gaia Education and CIFAL Scotland launched a four year project **Building Capacity and Empowering Communities** funded by the Scottish Government to improve sustainable food security and livelihoods of 42 vulnerable communities of Southern

Bangladesh. This project-based learning is building the capacity of community leaders to manage sustainable village development, horticulture and organic vegetable production, and canal fisheries projects. In addition, villagers are learning the skills necessary to build climate change-adapted homes across the region utilising natural building techniques.

From the start, the project adopted a holistic approach to poverty reduction while promoting a paradigm shift in food production and disaster management: from conventional relief-and-response practices to an integrated and regenerative risk reduction culture. Supporting this approach has been the introduction of eco-village and permaculture design practices, which have made significant progress toward the realisation of regenerative communities embedded in their bio-regions.

Results

Over three years, 140 community members from 42 communities have participated in a series of Design for Sustainable Settlements, Permaculture, and Climate Change Intervention courses. Curricula and learning outcomes were developed by national and regional experts, permaculture practitioners and local growers to effectively respond to an environment prone to adverse climate change. Villagers acquired practical skills in composting, vermiculture, mulching, herbal pesticides, and raised-bed cultivation, resulting in significant improvement in the productivity of the salinated soil. Brinjal, sweet pumpkin, gourd, okra, radish, tomato, cabbage, spinach, red and green leaves, chilli, potato, bean, korola, jinge and many other varieties have diversified their diet with direct impact on their health, well-being and self-esteem.

Furthermore, the project strengthened community participation in natural resource management with a total of 27 community-led, small income generation projects. Nine community organic gardens, six vermiculture and six horticulture sites, plus six canal fisheries have demonstrated the practical application of the lessons learnt in the heart of their communities. More than 75% of participants involved in small business project were women who have increased their family income and emerged as leaders in the battle against the effects of climate change. These same women have opened the first organic shop in Banishanta market, where they are selling their surplus produce and enriching their livelihoods.

Community members were convinced that the robustness of plants and the high productivity of the nurseries are a direct result of the natural techniques of vermicomposting, vegetative and liquid composting, and mulching on saline tolerant raised beds. With the learning taking place in their gardens and compounds through hands-on practical exposure, participating villagers have gradually assumed the role of educators to the wider community in spreading the techniques and sharing the results of their productive yields. Inspired by these trained change

agents, both directly and indirectly, women and men of different ethnic, cultural, and religious backgrounds are now engaged in similar horticultural and small income generation projects achieving remarkable success in terms of increased food production, household income, and community vitality.

Case Study 2

Country: Senegal

Name: Increasing Food Security, Income Generation and Environmental Sustainability in the Podor Region, Northern Senegal

Period: 1 April 2014 to 31 March 2017

Funded: UK AID

Problem

The agricultural viability of small-scale producers in the Podor region is under threat, due mainly to the transfer of the most productive land from food production for local needs to export for consumption by the global consumer class. Misguided industrial agriculture policies over the decades have undermined traditional methods of food production, turning the once productive soils by the River Senegal into a barren wasteland. The difficult situation is compounded by the relentless desertification of the Sahel, forcing small-scale producers to continually adapt with innovative solutions to keep feeding their communities.

Approach

A 3-year food security project engaging four villages of Podor Region of Northern Senegal – Guédé Chantier, Lahel, Moundouwaye and Diarra, aims to develop 16 hectares of community land to produce organic food more efficiently and increase the communities' resilience and capacity to adapt to the advancing effects of climate change. The project combines both indigenous and scientific knowledge into productive agroecological systems. The project aspires to strengthen the communities' social, economic and ecological competencies and build skills in agroforestry, permaculture, food processing and trade. It is directly benefiting over 3,000 community members, especially women, by enhancing their agricultural and socio-enterprise knowledge and skills.

Gaia Education has been conducting with its international and regional experts permaculture, agroforestry and food-processing capacity building activities. Agroforestry practices are regenerating the fragile ecosystem by storing carbon, preventing deforestation, increasing biodiversity, protecting water resources and reducing erosion.

Results

At the end of Year 2 we have seen outstanding results in the permaculture gardens. There is an abundance of produce demonstrating the effective transfer of knowledge and skills. Surveys related to the permaculture gardens conducted in March 2016 by local M&E agents trained by the project (Eco-sentinels) showed 100% of

the students are using compost, 80% liquid manure and 55% fish tonic – the three main permaculture techniques promoted by the project. Permaculture techniques and methods offered by the project have resulted in the cessation of the use of agro-chemicals on the 16 hectares. Soil nutrient tests performed in March 2016 and compared to January 2015 show the project has increased phosphorus and potassium levels without chemical additives. Additionally, villagers are now producing and consuming a more diverse array of food, which is improving nutrition and health.

Agroforestry nurseries have been initiated in each village allowing beneficiaries to gain skills in raising tree seedlings from seed to allow replacement of trees that perish while continuing to develop agroforestry systems after the project. This approach is 250 times cheaper than purchasing trees. Several people have been trained in how to operate and maintain pumps. The fencing perimeter will be planted with spikey plants to ensure a sustainable barrier to local predators.

In terms of attitudinal studies, pre- and post-surveys for 20% of participants were conducted for Agroforestry Training, Permaculture Training, Change Agent Training, Food Processing and Preservation Training, amid beneficiary-led demo events. In all cases, 100% reported the trainings to be relevant and beneficial. Furthermore, 120 beneficiaries were surveyed in March 2016 using one-on-one interviews, with the following results: 100% said they no longer spend anything on chemicals, 97% said they consume a more diverse diet, 100% said they buy less from the market, while 82% reported an increase in food production.

It's important to emphasize that women represent 85% of beneficiaries involved, a fact which is contributing to women's empowerment. Overall, women want to take an active part in reversing the trend of progressive destruction of their life support systems, both by the forces of climate change and the forces of globalisation. They are harnessing their creative efforts together, reviving traditional ways of gardening to ensure their families' security and well-being, and in the process reclaiming their land and their sovereignty.

Case Study 3

Country: India

Name: Empowering and Building Capacity of Tribal Communities of Four Gram Panchayats of Laxmipur Block of Koraput District in Odisha to Increase Food Security, Strengthen Social Cohesion, and Enhance Climate Resilience

Period: 1 April 2014 to 31 October 2016

Funded: Scottish Government

Problem

In Odisha 70% of the population is dependent on agriculture. Although endowed with rich natural resources, 66.2% of the population lives below the

poverty line. Thousands of tribal villages around the state are currently in danger of losing their ecological viability. Koraput District in particular was traditionally abundant but has become marginal due to the intrusion of cash crops and genetically modified seeds. Traditional varieties of millets, yam, and tuber crops are gradually disappearing. Sustainable indigenous lifestyles and cultural values are being lost in the process.

This project works to reverse this process. Developed by Gaia Education, THREAD and the women's confederation Orissa Nari Samaj (ONS), the project works with 750 tribal families to increase food security, build social cohesion, and address the deeper structural changes needed to tackle the root causes of poverty. The ONS network reports that overworked tribal women and girls of the region perform much of the agricultural labour and all of the domestic duties. After extensive discussions, the Koraput communities were selected as the most vulnerable in the region, demonstrating high levels of food insecurity and poor nutritional intake, low levels of skill development, combined with great aspiration for transformation.

Approach

Through integrated sustainable farming practices and agro-ecological approaches the project is improving the health of soils, diversifying crops, and enhancing the villagers' livelihoods and well-being. The heart of the project is the campaign 'Grow Your Own Food' to counteract so called "Climate Smart Agriculture" (CSA) techniques. CSA encourages the use of modified seeds, chemical pesticides, and synthetic fertilizers, as well as high-risk technologies such as synthetic biology, nano-technology and geo-engineering. This imposition of new biotechnology has been particularly damaging for farmers in Odisha.

The Grow Your Own Food campaign has two key components: a community learning element incorporating eco-village approaches, combined with seed preservation and distribution of seedlings of various fruits and vegetables. The campaign is continually developing new climate-resilient agricultural approaches rooted in traditional ways of growing food. Drought tolerant plants combined with mulching, fortified composting, vermiculture and vermicomposting, herbal pesticides and green manures have improved the productivity of soils and the nutritional value of meals. Members of the tribal communities also participate in annual eco-village design courses which incorporate locally relevant components of sustainable food production, including mixed cropping, nitrogen fixation, bio-fertiliser preparation and seed-bank development. Villagers are developing their own kitchen gardens, which will continue to grow after project completion. Tribal women attend seminars to enhance their skills in leadership, mediation and advocacy as important elements for peace-building, conflict resolution, and sustained social-ecological resilience.

Results

High yields in participating villages were the result of community engagement, access to water, and new skills acquired through agro-ecological capacity building activities. Villagers who experienced success in the first year by earning supplemental income through the sale of surplus produce encouraged and influenced fellow community members.

Monsoon is the real Minister of Agriculture of India as it controls the course of farming. Last year, a late and insufficient monsoon created difficulties for the kitchen gardens of the villagers. Instead of the usual two-and-a-half months of rain, the region received only 15 days. The women still managed to plant their saplings but the harvest was small. New water-use efficiency techniques for vegetable cultivation have been introduced through GE training programmes, and this year biochar techniques also will be incorporated to maintain soil moisture when rain is inadequate.

The continually changing environment of Odisha creates an imperative for ongoing learning through participatory methods which empower villages to take action for sustainable development through well-informed, locally adapted responses as sources of creativity and innovation.

Case Study 4

Country: Italy

Name: Sicilia Integra

Period: 1 March 2016 to 28 February 2018

Funded: LUSH

Problem

Each year thousands of men, women and children attempt a dangerous journey across the Mediterranean Sea to Europe. Many of them are trying to escape poverty, climate impact and war in their home countries. In 2015, the total number of refugees and migrants arriving in Italy by sea was estimated to be 153,850 persons (Italy - Sea Arrivals, UNHCR UPDATE #4, December 2015). Key disembarkation points remain Sicilian ports, which have been identified as hotspots with 83,017 migrant arrivals (UNHCR 2016).

Existing approaches to the problem have proven ineffective at finding long-term solutions for displaced populations. Humanitarian responses have been criticised for focusing too heavily on “care and maintenance,” leaving refugees essentially “warehoused” for years, with their lives in limbo. In Sicily, therefore, there is an urgent need for long-term workable solutions that can support the socio-economic integration of the growing influx of migrants while promoting new sustainable trends to enhance Sicilian local economies. In recent years there has been a revival of traditional methods of agriculture, including the highest number of organic operators (9,888 producers/processors) in Italy (SINAB, 2014); thus, the agricultural sector looms as a fertile opportunity for the productive integration of refugee populations.

Approach

Sicilia Integra aims to support the socio-economic integration of migrants arriving in Sicily through sustainable community and agro-ecological, capacity building activities with the view of creating an alternative trading platform for the commercialisation of Sicilian organic products in European markets. Furthermore, the project aims to foster the professionalisation of migrants and unemployed youth, creating new jobs opportunities in regenerative agriculture while contributing to the development of a Sicilian sustainable economy.

Sicilia Integra has been developed by Gaia Education and the University of Catania in partnership with the Don Bosco 2000 and I Girasoli migrant welcome centres, Organic Farmers Cooperatives and European ethical organic food companies. The project is offering training and livelihood opportunities to migrants coming from North Africa and Asia, as well as young unemployed Sicilians, facilitating their integration into organic farming communities while promoting transformation of local economies.

Utilising sustainable community design and regenerative agriculture methods, Sicilia Integra aims to build the capacity of immigrants and asylum seekers over a period of three years to enhance solidarity between newcomers and local communities, encouraging collaborative decision-making while recognising the immense power for social change that lies in building multicultural communities. The learning journey includes ecological design skills to minimise the impact of and develop resilience to climate change in food, land, biodiversity and water systems, bringing ‘culture’ back to agri-culture, and understanding the diversity of cultural influences on food patterns.

Results

Before being integrated into the organic farming communities, migrants take a 5-week course designed to provide knowledge and practical skills on regenerative and organic farming techniques in the context of the three dimensions of sustainability – environment, society and economy, with culture as an underlying dimension. Seventeen migrants and two unemployed Sicilians joined the first course “Design for Sustainability and Organic Food Systems” which took place in Piazza Armerina in Spring 2016. All graduates have now entered a 6-month, on-the-job training apprenticeship.

Sicilia Integra advocates that immigration can represent a ‘transformational’ opportunity and an effective way to ease people out of situations of vulnerability, building long-term resilience for both migrant and host communities.

Conclusion

The adoption of the 2030 Agenda for Sustainable Development last year marked a watershed event for sustainable development. Its 17 Sustainable Development

Goals (SDGs) and 169 targets are expected to stimulate action over the upcoming years in areas of critical importance for people and planet. The breadth and depth of the SDGs is unprecedented. Adopting a rights-based approach, the new agenda aims to leave no-one behind, while promoting social inclusion for the most vulnerable groups. At the same time, it acknowledges that all ecosystems are interlinked and sets the environmental limits and critical natural thresholds for the use of natural resources.

With its vital Goal 4 directed towards education and its related targets, the 2030 Agenda for Sustainable Development recognises that education is essential for the successful implementation of all SDGs. Education is included for goals on health, employment, sustainable consumption and production, and climate change. This reflects an international consensus that sustainable development *begins* with education, but what sort of education?

Gaia Education has been creating learning environments which support individuals and communities to examine critically the technologies, linear systems of economic production, cultural systems of reproduction, and ideas and ideologies that are currently employed as status quo. Yet Gaia Education not only critically examines the sources of problems, it also offers a range of viable alternatives upon which individuals and communities can take conscientious action. Inspired by decades of experience with the global impulse of eco-villages and sustainable communities, Gaia Education embodies a 'living and learning,' goal-directed, transformative pedagogy which can be characterised by participation, problem-solving and project-based capacity building. Such pedagogical approaches make possible the development of key competencies needed for promoting sustainable development as a process of the life-long learning of communities rooted in place

In this paper, we took a look at how Gaia Education is contributing to the SDGs through a series of innovative, capacity building, project-based learning prototypes being developed in areas of the world impacted by climate change. GE's pedagogical and epistemological lineage has proven to be quite adept at instilling and inspiring confidence in local communities to explore and find *indigenous* solutions to local problems, and in the process empowering communities in their quest for dignified, self-directed sovereignty. What sets Gaia Education apart is its four-fold representation of sustainability - adding culture or worldview as an essential underlying dynamic to the traditional triad of society, environment, and economy - as well as the ease with which a GE team of educator-practitioners can enter a community and co-participate as equals in the mutual goal of improving quality of life for all concerned.

The four projects examined here all had in common an approach to sustainable food production that rejects the

resource-intensive, technologically dominated, expert controlled paradigm imposed by the corporate agribusiness forces of globalisation. For food production to become truly sustainable, and for agriculture to be capable of feeding the projected 9 billion people by 2050, it must return to locally-sourced, community-led enterprises managed bio-regionally. A whole succession of publications, including many by the Food and Agriculture Organization of the United Nations (FAO) identifies this type of agriculture as being "agroecology," or the design of farms as if they were ecosystems, enhancing the harmonic interactions between plants, animals, humans and the environment (Francis et al. 2003). It is in this type of management that indigenous knowledge and traditional cultural patterns become preeminent, for, in an elegant sort of irony, a mature agroecological system evolves into a *foraging* system, excelling in qualities of nutrition, genetic diversity, local adaptability, and the wholesome stewardship of Nature.

Bibliography

Altieri, M.A. (2004) Linking ecologists and traditional farmers in the search for sustainable agriculture. *Frontiers in Ecology and Environment*, 2(1), 35-42

DOI [10.1890/1540-9295\(2004\)002\[0035:LEATFI\]2.0.CO;2](https://doi.org/10.1890/1540-9295(2004)002[0035:LEATFI]2.0.CO;2)

Altieri, M.A. (2012) The scaling up of agroecology: Spreading the hope for food sovereignty and resiliency. SOCLA's Rio+20 position paper. Available at <https://foodfirst.org/wp-content/uploads/2014/06/JA11-The-Scaling-Up-of-Agroecology-Altieri.pdf>

Altieri, M.A., Funes-Monzote, F.R. & Petersen, P. (2011) Agroecologically efficient agricultural systems for smallholder farmers: Contributions to food sovereignty. *Agronomy for Sustainable Development*, 14 December. Springer-Verlag, DOI [10.1007/s13593-011-0065-6](https://doi.org/10.1007/s13593-011-0065-6)

Altieri, M.A. & Nicholls, C.I. (2013) The adaptation and mitigation potential of traditional agriculture in a changing environment. *Climatic Change*, 13 September. DOI [10.1007/s10584-013-0909-y](https://doi.org/10.1007/s10584-013-0909-y)

Altieri, M.A., Koohafkan, P. & Nicholls, C. (2014) Strengthening resilience of modern farming systems: A key prerequisite for sustainable agricultural production in an era of climate change. *Third World Network, Briefing Paper 70*, January

Berkes, F. & Folke, C., editors (1998) *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge University Press; Cambridge, UK

Brokensha, D., Warren, D.M. & Werner, O. (1980) *Indigenous Knowledge Systems and Development*. University Press of America; Lanham, MD

- Context Institute, (1991/1994) *Eco-Villages and Sustainable Communities: A Report for Gaia Trust*. Context Institute; Bainbridge Island, WA
- Conway, C. (1997) *The Doubly Green Revolution: Food for All in the 21st Century*. Cornell University Press; Ithaca, NY
- Critchfield, R. (1983) *Villages*. Anchor Books; Garden City, New York, NY
- Critchfield, R. (1994) *The Villagers*. Anchor Books; New York, NY
- Denevan, W.M. (1995) Prehistoric agricultural methods as models for sustainability. *Advanced Plant Pathology*, 11, 21-43
- De Schutter (2010) Report submitted by the Special Rapporteur on the right to food. United Nations General Assembly. Human Rights Council, sixteenth session, agenda item 3 (A/HRC/16/49)
- Ericksen, P.J. (2007) Conceptualizing food systems for global environmental change research. *Global Environmental Change*, 18(1), 234-245
DOI: [10.1016/j.gloenvcha.2007.09.002](https://doi.org/10.1016/j.gloenvcha.2007.09.002)
- Ewell, J.J. (1999) Natural systems as models for the design of sustainable systems of land use. *Agroforestry Systems*, 45, 1-21
DOI: [10.1023/A:1006219721151](https://doi.org/10.1023/A:1006219721151)
- FAO (Food and Agriculture Organization of the United Nations) (2004) *Globalization of food systems in developing countries: Impact on food security and nutrition*. FAO Food and Nutrition Paper 83; Rome
- FAO (Food and Agriculture Organization of the United Nations) (2014) *Sustainability Assessment of Food and Agriculture Systems: SAFA Guidelines, Version 3.0*; Rome
- Feagan, R. (2007) The place of food: Mapping out the 'local' in local food systems. *Progress in Human Geography*, 31(1), 23-42
DOI: [10.1177/0309132507073527](https://doi.org/10.1177/0309132507073527)
- Freire, P. (1970) *Pedagogy of the Oppressed*. Continuum International Publishing Group, Inc.; New York
- Fukuoka, M. (1978) *The One-Straw Revolution: An Introduction to Natural Farming*. New York Review Books; New York
- Gliessman, S.R. (2014) *Agroecology: The Ecology of Sustainable Food Systems*, Third Edition. CRC Press; Boca Raton, FL
- Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M. & Toulmin, C. (2010) Food security: The challenge of feeding 9 billion people. *Science*, Vol. 327, 12 February, 812-18
DOI: [10.1126/science.1185383](https://doi.org/10.1126/science.1185383)
- Goma, H.C., Rahim, K., Nangendo, G., Riley, J. & Stein, A. (2001) Participatory studies for agro-ecosystem evaluation. *Agriculture, Ecosystems and Environment*, 87, 179-190
DOI: [10.1080/14735903.2012.676797](https://doi.org/10.1080/14735903.2012.676797)
- Harris, J.M., editor (2003) *Rethinking Sustainability: Power, Knowledge, and Institutions*. The University of Michigan Press; Ann Arbor
- Imhoff, D. & Baumgartner, J.A., editors (2006) *Farming and the Fate of Wild Nature: Essays in Conservation-Based Agriculture*. Watershed Media; Healdsburg, CA
- IASSTD (International Assessment of Agricultural Knowledge, Science and Technology for Development) (2009) *Agriculture at a crossroads*. In IAASTD Global Report, Island Press; Washington, D.C.
- IIED (International Institute of Environment and Development) (2013) *Agriculture and food systems for a sustainable future: An integrated approach*. Briefing Sheet, May
- Kimbrell, A., editor (2002) *The Fatal Harvest Reader: The Tragedy of Industrial Agriculture*. Island Press; Washington, D.C.
- Kotke, W.H. (2007) *The Final Empire: The Collapse of Civilization: The Seed of the Future*. AuthorHouse; Bloomington, IN
- Leakey, R. (1994) *The Origin of Humankind*. Basic Books; New York
- Lott, M. (2011) 10 calories in, 1 calorie out: The energy we spend on food. *Scientific American*, 11 August. Retrieved May 26, 2018 at <https://blogs.scientificamerican.com/plugged-in/10-calories-in-1-calorie-out-the-energy-we-spend-on-food/>
- Malkina-Pykh, I.G. & Pykh Y.A. (2003) *Sustainable Food and Agriculture*. WIT Press; Southampton, UK
- Matson, P.A., Parton, W.J., Power, A.G. & Swift, M.J. (1977) Agricultural intensification and ecosystem properties. *Science, New Series*, Vol. 277, 25 July, 504-509
DOI: [10.1126/science.277.5325.504](https://doi.org/10.1126/science.277.5325.504)
- Norberg-Hodge, H., Merrifield, T. & Gorelick, S. (2002) *Bringing the Food Economy Home: Local Alternatives to Global Agribusiness*. Zed Books; London

- Norgaard, R.B. (1994) *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. Routledge; London
- Pretty, J.N. (1995) Participatory learning for sustainable agriculture. *World Development*, Vol. 23, No. 8, 1247-1263
- Pretty, J., editor (2005) *The Earthscan Reader in Sustainable Agriculture*. Earthscan Publications, Ltd.; London
- Richards, P. (1985) *Indigenous Agriculture Revolution*. Hutchison and Co., Ltd.; London
- Narayanasamy, N. (2009) *Participatory Rural Appraisal: Principles, Methods and Application*. Sage Publications India Pvt Ltd.; New Delhi
- Netting, R.M. (1993) *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*. Stanford University Press; Stanford, CA
- Saifi, B. & Drake, L. (2008) A coevolutionary model for promoting agricultural sustainability. *Ecological Economics*, 65, 24-34
DOI: [10.1016/j.ecolecon.2007.11.008](https://doi.org/10.1016/j.ecolecon.2007.11.008)
- Scherr, S.J. & McNeely, J.A. (2007) *Farming with Nature: The Science and Practice of Ecoagriculture*. Island Press, Washington, D.C.
- Schmookler, A.B. (1984). *The Parable of the Tribes: The Problem of Power in Social Evolution*. University of California Press; Berkeley
- Shiva, V. (2000) *Stolen Harvest: The Hijacking of the Global Food Supply*. South End Press; Cambridge, MA
- Smith, P. & Gregory, P.J. (2013) Climate change and sustainable food production. *Proceedings of the Nutrition Society*, Vol. 72, 21-28
DOI: [10.1017/S0029665112002832](https://doi.org/10.1017/S0029665112002832)
- Uphoff, N., editor (2002) *Agroecological Innovations: Increasing Food Production with Participatory Development*. Earthscan Publications, Ltd.; London
- World Food Programme (2007), *Food Security Assessment Bangladesh*
- Wirzba, N., editor (2003) *The Essential Agrarian Reader: The Future of Culture, Community, and the Land*. Shoemaker & Hoard; Washington, D.C.