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ENABLING MORE REGENERATIVE AGRICULTURE, FOOD, AND NUTRITION IN THE ANDES

The relational *bio-power* of "seeds"

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Introduction

Rural development initiatives do not just seek *sustainable* solutions (i.e., results that continue or prolong over a period of time in relatively static or linear form), but also more *regenerative* ones (outcomes that renew and revitalize productive processes in ways that grow, expand, and diversify), ultimately contributing to the enhancement of people's material needs, but also their self-esteem and a sense of ownership, autonomy, and creativity – what we understand as the subjectivities of catalytic, lasting social change and development. In agronomy and health, one approach that is commonly called for in the literature is agro-biological and nutritional "diversification" – of the processes involved in on-farm production, consumption, circulation, and exchange for multiple purposes of health, wealth, and environment as well as the social.

In this age of broad-scale socio-biological decline in regions such as the highland Andes, as per Carolan (2011), we propose a look at agrobiodiversity and nutrition as an embodied form of inter-dependence and co-existence in and through food. Inherent in this *relational* perspective is a criticism over the common depiction of agrobiodiversity in the modernist literature as well as in public policy as an inanimate object and commodity, thereby creating the abstraction that agriculture, food, and nutrition are the product of a series of highly instrumental, independent, and linear chain-like linkages composed of discrete value. Instead, here we understand the "seed" as an embodiment of human-nonhuman *biopower* of genetic resources found in plants, animals, and microbes. In considering agrobiodiversity as part of an emergent, aesthetic order (rather than a natural one), the state of agriculture and health at any given moment is understood as the outcome of a value achieving process based on unfolding human-nonhuman legacies that are laden with potential – for harvesting sunlight and the provision of fiber, food, and energy as well as the generation of social worth and economy.

In this chapter, we employ a relational perspective to shed fresh light on three strategic interventions in food diversification as a means of helping rural people in the remote Andes to address their health concerns: 1) the multiple-purpose re-introduction of high-protein legumes to address nutritional deficiencies in vulnerable infants and mothers as well as soil fertility in Potosí, Bolivia, 2) the promotion of native potato landraces with high iron, zinc, and vitamin C in Huancavelica, Perú, and 3) the introduction of a vegetable food-basket or *canasta* as a means of creating demand and culture for nutrient-rich vegetables during the first "1,000 days of life" in Imbabura, Ecuador. In reflecting on these experiences, we ask, how is agrobiodiversity part of life regenerating forces of process and the emergence of more regenerative food and nutrition?

Malnutrition and the life-structuring potential of seeds

According to the Pan American Health Organization (PAHO), many women in poor regions of the highland Andes begin pregnancy in a condition of poor nutrition, which translates into a delay in intrauterine growth of the fetus. As a consequence, infants and young children in rural areas commonly start life with stunting and an increased susceptibility to disease, which can require special care and draw on the precious time and resources of families as well as public services. This situation is commonly attributed to the limited access of families to an adequate quantity and quality of food, to inadequate conditions of potable water and hygiene, and health care.

Being the only complete food during the first six months of the child's life, breast milk provides high-quality nutrients that can be absorbed easily, while protecting a child from infections and disease (León-Cava et al. 2002; UNICEF 2005). As a result, the World Health Organization recommends exclusive breastfeeding for at least the first six months of a child's life, and ideally for two years, and supplementing with a diet of nutritious foods.[1] Well-nourished children tend to be healthier, more productive, and more capable at learning; while malnourished children tend to have less capacity to learn and to be productive, which in turn, can contribute to a pernicious cycle of poverty in families and in the community.

As per the work of Reyes-García and Benyei (2019) that identifies multiple pathways of linking agrobiodiversity and maternal health and breastfeeding, here we utilize the seed as a metaphor that encapsulates an interactive, largely plant-based means of socio-biological and socio-material potential, in this case for enabling rural families to address concerns over malnutrition of highly vulnerable mothers, infants, and children. As Aistara (2019) explains, the social research on agriculture and food has largely overlooked a relational perspective when seeking to understand agrobiodiversity, leading to at least two consequences. First, when considering the social value and "life" of seeds, the identity and qualities of the seed taken on specific significance to the user and can provide an important basis for shaping her or his identity and sense of being. Secondly, with the perception of genetic resources as centers around which social networks emerge, seeds enter the realm of ownership, power, inclusion, and exclusion.

Moreover, agrobiodiversity is not a stable phenomenon. Rather, agrobiodiversity is the result of endlessly evolving interactions between people and their associations, whether in processes of production, consumption, circulation, health, sustainability, or equity (as well as their antipodes). When extracted from its social or environmental situation, for example, when leaving a field or plate and entering a laboratory or gene bank, only a limited number of the multifaceted and highly nuanced socio-biological and material qualities of agrobiodiversity

survives. As a result, here we understand agrobiodiversity, as embodied in a seed, as a promising form of relational *biopower* that is both life-conserving and life-structuring.

Enabling more regenerative nutrition in the Andes: three projects

Yanapai: improving nutrition through potato biofortification

The Chopcca people live in highland communities that are situated between 3,400 and 4,500 meters above sea level, including 13 populated centers of Huancavelica, Peru. The population of the region is about 10,500 people, of which the vast majority are native Quechua speakers. During the period of civil unrest in 1980–1992, the Chopcca refused to allow either the Shining Path revolutionaries or the government's military into its communities. As explained in Roel-Mendizabel and Martinez-Vivanco (2013), today, the tenacious Chopcca spirit of resistance is captured by its people's unusual commitment to wearing traditional dress.

In large part tied to the extreme environment and living conditions of the highlands, Huancavelica has the highest rate of chronic malnutrition in Peru at 54.6% (INEI 2012). Height to age data taken for children under 3 years of age indicates chronic malnutrition among children at 44.2%. Agrarian reform arrived in Chopcca communities in the early 1970s, and presently, the distribution of land is based on a mixture of family-owned and collective property. The highland climate is marked by a dry season from June to August, with morning temperatures commonly below 0°C, and a wet season from September to May. The chief economic activity is small-scale family farming, based mainly on the cultivation of potato and barley as well as a suite of complementary crops, such as field bean, pea, oca, olluco, mashua, and tarwi or lupine bean. In addition, families commonly rear limited livestock, including sheep, cattle, and pigs as well as smaller animals in and around their homes, such as guinea pigs and chickens.

During the rainy season the Chopcca collect sundry leafy herbs, such as yuyo (*Brasica campestris*), olluco leaf, potato leaf and some families grow wild, *sacha* cabbage. Some vegetables such as onions, carrots, celery, squash are obtained either through barter or currency exchange at a weekly farmers' fair in the district capital, Paucará. The largest populated center of the Chopcca community, Ccasapata, organizes a weekly fair, where people can find vegetables, fruits, llama fat and viscera, and dried, salted fish as well as haberdashery and clothing.

Between 2011 and 2015, Grupo Yanapai, in collaboration with the National Institute of Nutritional Research, implemented the project, "Agrobiodiversity and Nutrition for Food Security in Chopcca Communities, Huancavelica". In 2010, about 42% of children under 5 years of age in the project area experienced malnutrition. The objective of this action-research intervention was to address food insecurity, in particular of vulnerable girls and women through enhanced functional diversity of its staple food source: potato. Strategies to improve agrobiodiversity included the introduction of potato cultivars with high iron and zinc content and new cultivars of traditional Andean roots and tubers, the promotion of mixed varieties with diverse disease tolerance (a traditional practice), tarwi, field beans, barley, and cultivated pastures (ryegrass with red clover) for feeding guinea pigs and chickens. In addition, Yanapai provided specialized, on-hand training for women and mothers in child nutrition, largely based on improved traditional recipes for meeting the nutritional requirements of infants between 6–36 months of age.

Yanapai's ex-post evaluations found that the lasting result of this approach was a marginal increase in the adoption of new potato, oca, mashua, and tarwi varieties, a tendency to raise a greater number of chickens for egg production, more precise information among women in the use, and revaluation of alternative food sources found in their farming, useful for improving the nutrition of their children and family. Nevertheless, measurable results in dietary changes were limited, although the sample showed a general decrease in malnutrition. The project identified significant changes that were not necessarily attributable to its activity, including a decrease in the number of farms under cultivation as well as an increase in the emigration of men and young families and other confounding factors. For example, soups, a traditional source of complementary feeding, actually were discouraged by certain nutritionists, who explained, "They [soups] are filled with liquid", arguing that the broth needed to be made more substantial with vegetables, carbohydrates, and meat. Participants explained that animals were considered a money-saving device for emergencies, so sacrificing them for child nutrition was deemed risky.

The process of introducing potatoes with high nutritional content was slow due to the need of lengthy field trials of three or more years in time. As a result, the new materials only arrived at the end of this assessment, and hence, their potential nutritional benefit for children and mothers was yet to be determined.

Despite favorable results in increased agrobiodiversity and knowledge tied to the training activities, the situation of children who failed to meet minimal nutritional requirements did not substantially change over the three years of the project. In part, this was attributed to the substantial contextual challenges of achieving healthy family nutrition in Huancavelica, in particular as a result of the harsh environmental conditions of the dry, barren highlands, limited access to potable water, and dietary preferences towards high carbohydrate foods as well as the limited timeframe of the project. One confounding factor was the fact that the most nutritious food products, such as tarwi, barley, potatoes, poultry, and eggs, commonly held the highest value in the market. Yanapai found that increased income from the sale of high value farm products as well as the generation of off-farm income, including temporary migration and direct payments from social programs, often did not have a measurable effect on improving maternal or child nutrition.

As published in Arce et al. (2016), Yanapai ultimately found that under the uniquely harsh conditions of rural Huancavelica, Chopcca farming was only partially capable of providing sufficient production for meeting the household-level energy, iron, and zinc nutritional demands (Figure 22.1). Of the tested interventions (increasing potato yield, introduction of biofortified potato, and the promotion of guinea pigs), the study identified that a mixed strategy held the greatest promise for reducing nutrition gaps. The research concluded that production potential of high-altitude Andean agriculture based on low-fertile land and essentially no irrigation was inherently low. As a result, household food security depended on not just effective agronomic interventions, but also the strategic mobilization of off-farm income opportunities and associated food procurement.

World neighbors: legumes for soil fertility and nutrition

Located in the isolated, precipitous, and semi-arid, highland mountains of Bolivia, the department of Potosí contains the highest indicators of rural poverty and food insecurity in the Americas. According to government statistics, over 96% of families do not meet their basic food needs, and child malnutrition ranges from 40 to 60%. Depending on elevation, typical crop rotations in the area include potato or maize as the first crop after fallow, followed by fava

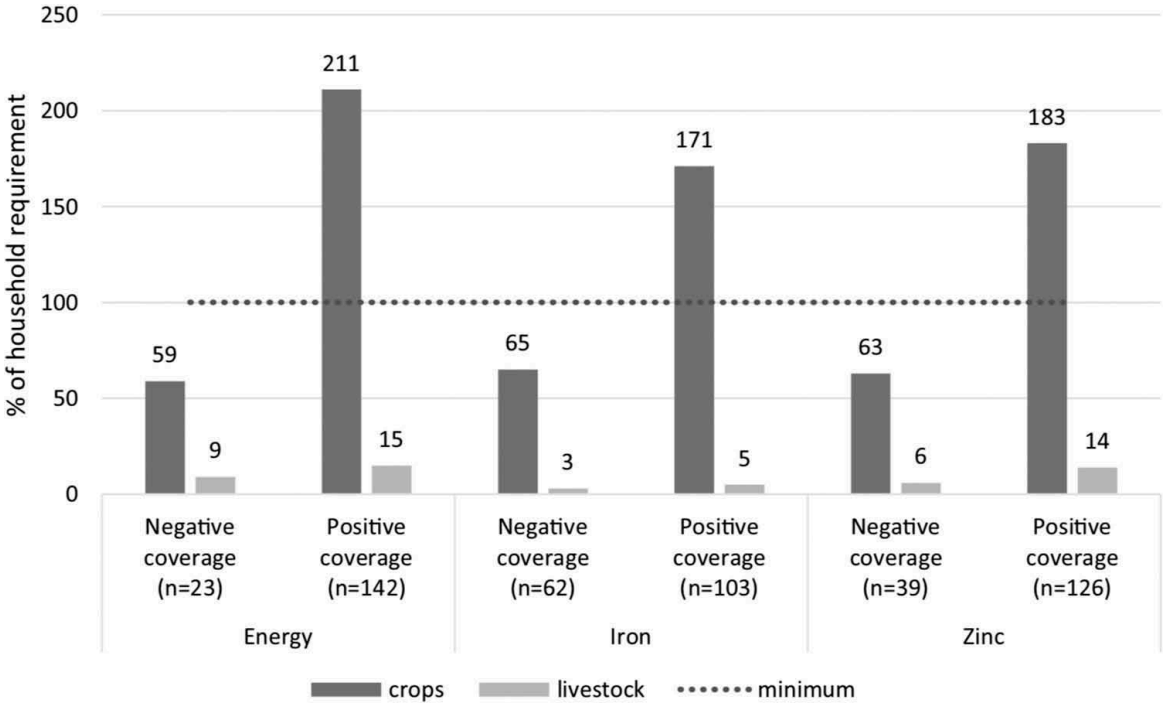

Figure 22.1 Contribution of crop and livestock production to the energy, iron, and zinc balance for households with a positive and negative coverage for each nutritional parameter. Dotted line (y=100%) represents basal household-level demand for full coverage.

Source: Arce et al. 2016

beans, small grains (wheat, barley, and forage oats), quinoa, and tarwi, followed by two to six years of soil "resting" or recovery. Sheep, cows, and llamas are important as economic assets, sources of meat and draft power as well as for their manure for agriculture. Overgrazing and the shortening of fallow periods of fragile hillside soils, however, commonly contributes to land degradation and decreasing crop yields. In addition, seasonal labor migration, mostly of men to nearby Argentina and Brazil, has created an acute labor shortage in rural villages.

The activity reported here took place in three major phases unrolled between 2005 and 2013. Working with Cornell University and local farmer experimenters, World Neighbors initiated action-research on agrobiodiversity as a means of strengthening the relationships between food security, soil health, and legume-based food and forage crops. Collaborating agencies included Bolivia's Forage Research Center (CIF), the Pairumani Center for Ecological Plant Genetic Research (CIPF), and a government-supported Hillside Agriculture Project (PROLADE) as well as the administrative and logistical support of state-based municipalities (*alcaldías*) and indigenous-based sub-municipalities (*sub-alcaldías*).

The first phase (2005–9) of the program emphasized the introduction of legumes in order to improve not only family diet, but also soil fertility. The most promising studied dual-use species were: broad bean (*Vicia faba*), pea (*Pisum sativum*), bean (Phaseolus vulgaris), tarwi (*Lupinus mutabilis*), and peanut (Arachis hypogaea). In addition, the project conducted trials on the following green manures solely for soil fertility improvement: arquilla (a wild legume, *Parocela pacense*), hairy vetch (*Vicia dasycarpa*), and forage oats (*Avena sativa*). The assumption was that the introduction of legumes would result in higher crop yields as a result of increased nitrogen fixation in soils as well as greater nutrition as a result of increased consumption of legumes in the family diet.

Between 2005 and 2008, 394 farmer-led variety trials were carried out, with the participants from each altitudinal zone involved in the selection of materials with the highest yield, the best adaptability, and culinary acceptance as well as N-fixation and biomass production (for example, see Figure 22.2). Similarly, 40 on-farm trials were established with vetch, tarwi, beans, and peas to improve soil fertility through biomass production. The project provided improved seeds, chemical inputs, tools, and fences for the plots as well as notebooks for farmers to record the performance of trials. The technical team carried out the follow-up and advice to the farmers, who were in charge of crop management. In all, World Neighbors held 470 field visits, 267 community workshops with men and women, and 16 cross-visits and learning tours. Meanwhile, the team of nutritionists and nurses trained women in legume-based cooking and nutrition, and they helped to form 12 mothers' clubs.

A second phase (2009–2010) focused on the barriers that mothers faced to improve the feeding practices of infants and young children, involving 195 households from the 13 communities involved in the initial phase. Between June 2009 and January 2010, a Nutrition PhD student from Cornell University led workshops based on the modified version of the Improved Practice Essays (EPM) based on Dickin et al. (1997). The action-learning agenda focused on nutrition education, with emphasis on how to improve the dietary practices of children under 2 years of age by means of available foods, breastfeeding,

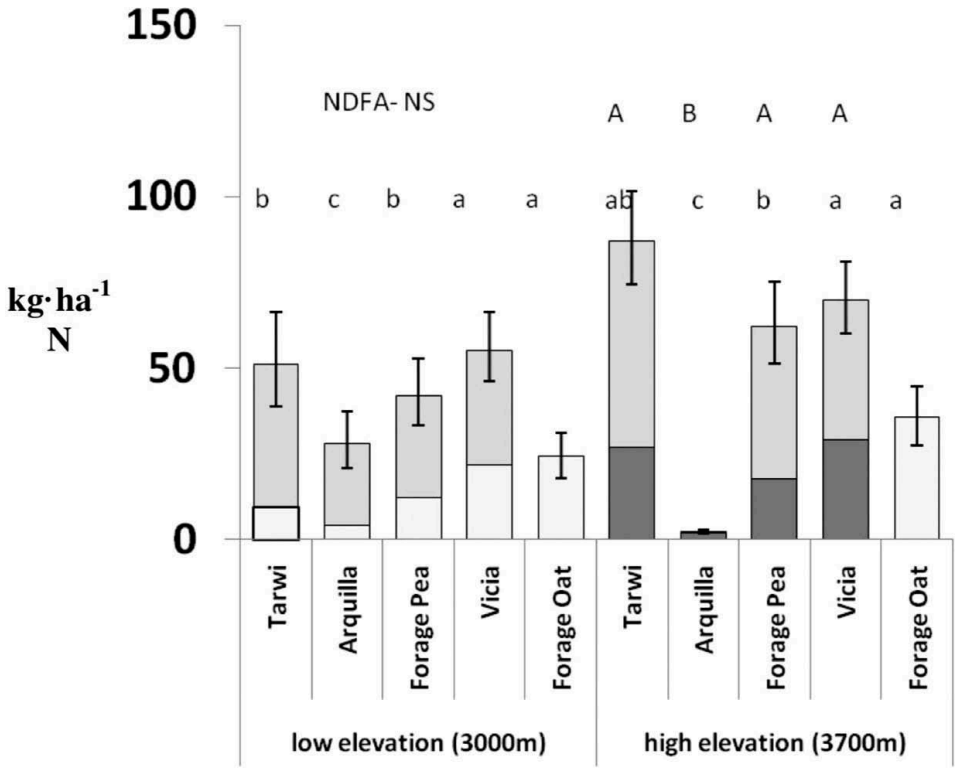

Figure 22.2 N soil stock (bottom light section of bar) plus fixed atmospheric N (top darker section of bar) of four species at two highland altitudes at sites in Northern Potosi. Capital letters denote statistically equal means for Nitrogen derived from N_2 fixation (Ndfa). Lower case letters denote statistically similar means for Ndfs. NS signifies No Significant Differences.

Source: Vanek 2011

and complementary feeding. The intervention methodology incorporated innovative visual tools, including child drawings and videos. In 2010, the team took part in a critical self-assessment of its work, leading to the launch of a third phase.

From 2010-13, the project reduced the intervention communities to five, with activities focusing on strengthening the earlier work in breastfeeding, complementary feeding, and dietary diversity. An additional issue, family support, was added as a new priority based on the results and reflections of the previous phases. Nutrition education workshops continued, with the difference that in this phase they were more dynamic, interactive, and organized around the employment of visual tools, including Participatory Video, Visualization of Processes and Participatory Programs (VIPP), and Participatory Action Research (IAP), recognized for promoting a democratic, horizontal, and creative participation of all participants. In addition, these activities involved the entire family: women, men, and children. Three workshops were held for each theme. The first workshop documented local knowledge; the second introduced scientific knowledge (comparing it with local knowledge and generating a dialogue about both), and the third involved a consultation with participants on changes that were necessary for improving infant and family feeding. In addition, the project added two new strategies: 1) "family accompaniment", which consisted of home stays of highly vulnerable families, during which project staff accompanied a family in its daily chores, with the objective of documenting, observing, and reinforcing key messages; 2) "native food day", which involved the preparation of traditionally nutritious foods and discussions of the importance of food in local culture.

With regard to the utilization of agrobiodiversity, and in particular legume-based green manures for soil fertility improvement, subsequent research concluded that soil management in rural Northern Potosi was oriented towards food production on a yearly timescale, whereas soil erosion and rangeland degradation accrued over decades (Vanek and Drinkwater 2013). Animal manure applications, and to a lesser extent the use of legume-based green manures, were sufficient to mitigate erosion impacts on crop yields, at least at present. As a result, soil degradation was not as swiftly apparent and could not be factored into short-term decision-making. Researchers found that management nested within environmental constraints, such as soil erosion and fertility loss, drove soil nutrient sustainability. They determined that the time-lag between management and long-term degradation was a principal sustainability challenge for farming in severe Andean highland conditions.

World Neighbors' ex-post evaluation corroborated the complexity of improving child nutrition in rural villages, where heavy workloads for mothers limited ability to prepare nutritious foods or to have the rest and time required for breastfeeding. Meanwhile, parents had come to believe that modern, processed foods were healthier and more prestigious. This reflection on the three phases led to three major insights. First, increases in food production did not necessarily translate into household-level improvements in nutrition. Second, the approach of working with mothers to improve nutrition was not enough to enable substantial change in health practices. Each family member influenced the possibility of health and disease. Although the mother commonly was primarily responsible for the care of children during the first years of life, the child's diet and nutrition depended on negotiations among adult members of the household, in particular the husband and mother-in-law. As a result, intra-family relationships merited special attention. Finally, the emphasis on improving mothers' cognitive knowledge in nutrition was deemed helpful, but insufficient in isolation of the contextual barriers in family and the community.

World Food Program: "the first 1,000 days of life"

In Ecuador, 23.9% of children under 5 suffer from chronic malnutrition. In rural highlands, these figures climb to over 50% of all children (Freire et al. 2014). A quarter of children are deficient in micronutrients, such as iron, zinc, or vitamin A, which can lead to chronic anemia. One-third of children between 5 and 11 years of age and more than 60% of the adult population between 19 and 59 are overweight or obese. Today, the double-burden of malnutrition – simultaneous under- and over-nutrition – is well established in both urban and rural Ecuador.

Operating from within the framework of the United Nations' Sustainable Development Goals and the "Zero Hunger Challenge" initiative, the World Food Program (WFP), in collaboration with Ecuador's Coordinating Ministry for Social Development (currently the Secretariat for Whole Life Planning), the Ministry of Economic and Social Inclusion, the Ministry of Public Health, the Ministry of Agriculture, and the Provincial Government of Imbabura, implemented the "Food and Nutritional Security" project in five parishes of Ibarra and Cotacachi. This project strategically targeted the "First 1,000 Days of Life", an effort to address the food and health monitoring needs during a woman's pregnancy as well as during the first year of a newborn child. This was addressed through regular medical check-ups, the provision of a diverse family diet by means of a regular food basket or *canasta*, and frequent capacity-building activities.

In order to diversify diets, the project sought the co-responsibility of beneficiary families in the constitution and delivery of a monthly fresh food basket per family, valued at $40 per month over a period of 15 months. The products offered in the basket were selected based on identified nutrient gaps of vulnerable people in the area and locally available foods, including both traditional Andean crops and European vegetables. As a result of concern over rising rates of overweight/obesity, the project also sought to decrease the consumption of carbohydrates.

Ex-post evaluation surveys identified an increase in the variety of fresh food in the diet of participating families, including fruits, vegetables, legumes, and animal-based proteins found in poultry, eggs, and meat and dairy products. As presented in Figure 22.3, this led to positive tendencies in anthropometric measurements of infants and children. The curves represents the weight for standard age made by the World Health Organization and the data of the beneficiary population surveyed by the Minimum Acceptable Diet. Children initially identified in a state of severe malnutrition were lifted to a moderate level of malnutrition. The evaluation found that trends in consumption were related to direct participation in the nutrition project, with an overall decrease in the consumption of fats and sugars that was significant. The project observed a reduction in the consumption of cereals, with a concomitant increase in the consumption of legumes as a source of energy and protein.

Subsequent critical review found that the delivery of monthly food baskets linked with nutrition-sensitive capacity-building and household visits led to an increase in the number of medical controls and a diversification in the family diet in ways that could improve the health of pregnant or lactating women with children under 2 years of age. When consulted about the reasons for success, project beneficiaries emphasized the importance of close collaboration with people working at the different ministries and institutions in the area. These agencies contributed logistical competence and organization stability as well as complementary financial resources to support nutrition activities, while allowing community leaders to establish needed relationships for other community concerns, such as improving roadways and schools. Nevertheless, the onerous logistical demands of a fresh food basket

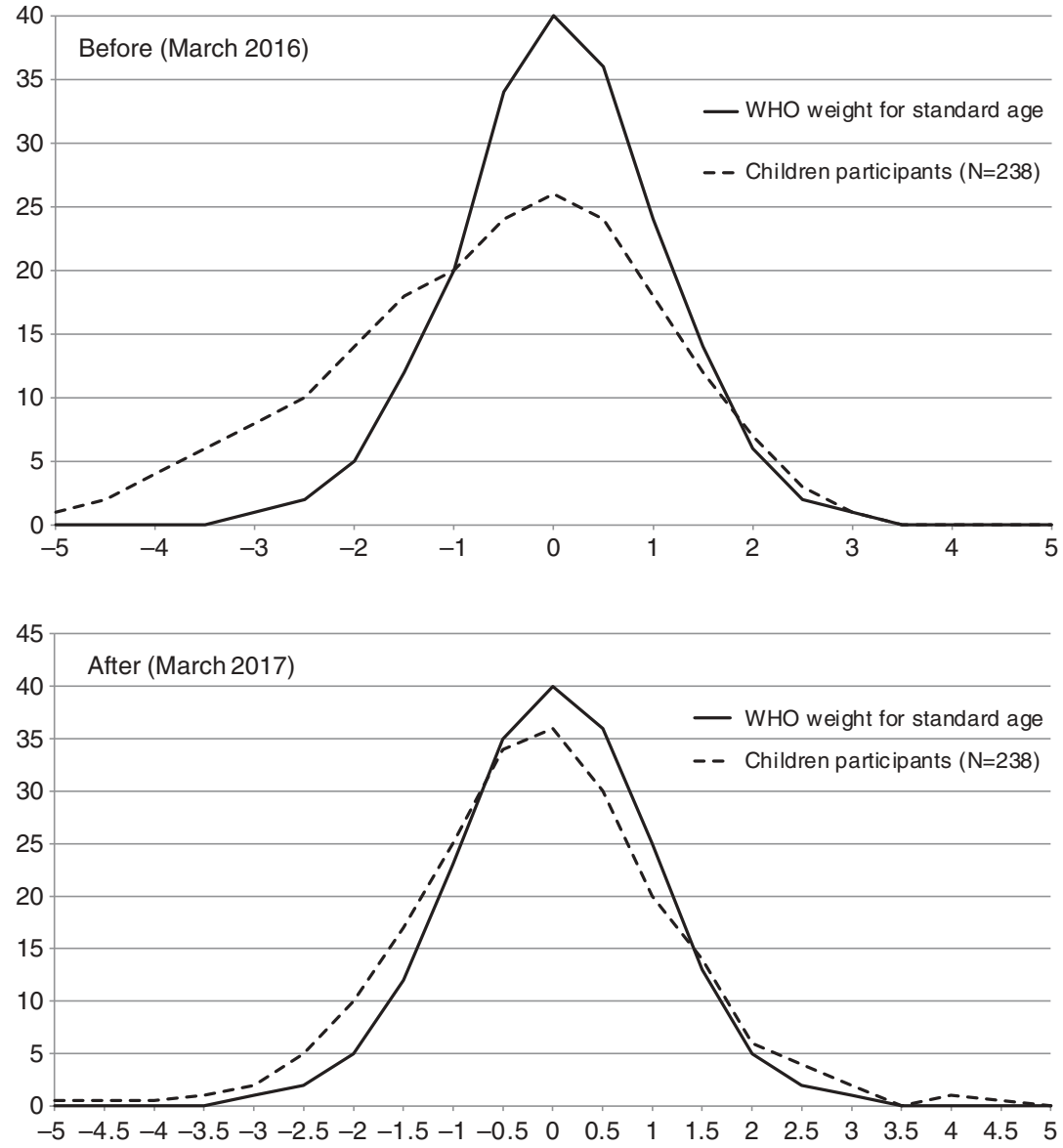

Figure 22.3 Changes in anthropometric measurements of children between the ages of 6–24 months of age involved in the 1,000 Days Project.

Source: WFP project survey

scheme raised concerns over dependence on externally based project support, placing into question the long-term viability of the work.

In response, the WFP found the up-front investment of financial and political resources necessary to "prime the pump" of demand for diverse, fresh foods in the project area. At the time of this research, it was experimenting with mechanisms to avoid or overcome dependence. For example, WFP increased the involvement of leaders and their organizations in the implementation of the food basket distribution system. The project strategically involved farmers and community health promoters in its training activities and monitoring and evaluation system as well as the design and implementation of subsequent corrective measures. Future priorities included the need to identify novel ways of strengthening producer-consumer ties, for example in administrative and financial management of the basket scheme, the creation of joint consumer-producer organizations, and special attention to new commercial opportunities.

Discussion

Investment in process

Each project sought to creatively utilize agrobiodiversity to address food security concerns, be it through strategy of biofortification in a long-standing staple crop (potato) as a means of addressing priority deficiencies (in particular, iron and zinc), the strengthening of legumes in production systems for dual purposes of improving soil fertility and nutrition (proteins and fats as well as feeding animals for meat), and diversifying diet by means of the regular production and distribution of diverse, fresh-food baskets (the *canastas*). The outcomes of this activity, however, were not always predictable or straightforward.

In the case of Northern Potosi, sometimes there was a conflict between the competing objectives of improving soil fertility and meeting immediate family nutrition needs, for example, when wanting to turn in cover crops at maximum nitrogen contribution of 80% flowering. Additionally, some of the most promising legumes, such as the green manure hairy vetch, were exotic and difficult to independently reproduce. Yanapai was successful in identifying biofortified materials, but the most nutritious potato was not always the most productive, tasty, or commercially attractive. In the case of WFP, the *canasta* system generated heavy logistical demands and products were not readily available from local producers, causing the project to purchase products from outside the area.

Faced with challenges in the form of acceptance, relevance, participation, and impact, each project introduced a number of processed-based innovations as a means of "narrowing distance" between the experience, needs, interests, and motivations of its project beneficiaries as well as the project staff itself. With the help of a PhD student, World Neighbors introduced Participatory Video, Visualization of Processes and Participatory Programs (VIPP), and Participatory Action Research (IAP). The WFP prioritized beneficiary monitoring of its training activities, and the direct involvement of beneficiaries in subsequent innovations. Meanwhile, Yanapai found the need to renew and strengthen community leadership and organization.

Despite the "high cost" of participatory development, for World Neighbors and WFP, attention to the quality of process was a necessary means of enabling innovation through "creating trust", "building confidence", and "enhancing local ownership" of learning-action processes. According to the World Neighbors' project coordinator, "We sought to organize our work around the rhythms of the community." In all cases, over time the demands of beneficiaries led to major changes in project priorities, designs, and the investment of resources. Through such means, distances – temporal, geographic, social, and otherwise – between project and intended beneficiaries were narrowed. Rather than seeds being used as an end, they became a means. Rather than pushing or imposing an externally defined agenda, the priority became bringing forth and co-generating a desired future – one that was healthier, more sustainable, more socially equitable and just. Over time, each of the three projects worked in its own way with the life force in agrobiodiversity to strengthen certain strategic relations – with soil, human body, neighbors, and difficult-to-reach institutions, thereby enabling previously neglected or unavailable potentials for transformation.

Hidden associations

Each of the projects erected its own conceptual borders dividing insides from outsides, families by household, youth from adults, mothers from fathers, indigenous first nations from moderns, traditional foods from modern food, soils from plants, varieties from other types of potato, health from disease. The Euclidean model of explanation continually assumes that threats (and solutions) come from the outside, rather than thinking of the present actuality as simply part of the state of things. A territory continually undergoes change wrought by mutable organisms and other agencies, transforming material states, social norms, and organization. The three cases presented here show that agrobiodiversity and food can be fundamental elements of this endless forging of the present.

In categorization of life, for example in creating closures around organisms and in creating limits of good and bad practice, farmers, development practitioners, researchers, agency officials, and others became involved in biopolitics. This happened in favor of certain worldviews and interests, including economics, for example, when determining a household or neighborhood healthy or sick, indigenous, naming a variety Andean, high in iron or zinc, or labeling a process productive or participatory. While there were degrees of truth in such determinations, as per the findings of past scientific activity and the rigors of good application of scientific method, such categorization was inherently partial and temporary. According to traditional Andean cosmovision, a potato, not unlike other organic forms, inevitably is in a continual state of (de)composition. What today constitutes the form of a potato, tomorrow may become part of an entirely new form: a soup, a petri dish auger, or a starch. Shining a light on a certain moment of that dynamic effectively hides others.

Hinchliffe et al. (2013) find that such geometrical mapping is selective, exclusive, and political. In the case of agrobiodiversity, it is strategically biopolitical. The resulting typology brings forth a certain world, with all of its contours of color, flavor, and taste, for example, at the cost of other possibilities. The introduction of modern agriculture and food in the 20th century is how Andean cosmology historically became unsettled and displaced by modernity. More recently, social activists have organized in alternative food networks as a form of sub-political counter-movement. Each project experienced confounding dynamics of each – pre-planned and emergent, modern and traditional, lay and scientific – at work in its activity.

The practice of agriculture, food, and health, not unlike other moments in reality, is fundamentally holomorphic and infinitely differentiable. As such, its characterization is inevitably partial and temporary. Nevertheless, bodies of science in agriculture and health have radically and strategically sought to reduce agriculture, food, and health (as well as other forms of life) to constituent elements, such as the farm, the producer, and consumer, a series of nutrients, fats, and amino acids as well as certain commodity forms, weights, flavors, and tastes.

Borders dividing realities are not just lines of difference, but also sites of encounter and contact, in particular among living organisms. Even though the potato may be self-pollinating, varieties compete in other ways – for example, with insects, weeds, and pathogens in the field as well as with micro-organisms in the soil, moisture, and nutrients. Similar to climate, market forces, the movement of genes, discourses, and narratives, the present is the product of the intensity of associations between and among organisms, for example, food and the body, pathogen and the host, a plant and the soil. Through workshops, field trials, cross-visits, and other encounters, the projects played with

borderlines to expose participants to previously unseen or neglected phenomena, thereby unleashing the potential of fresh experience and creativity on the present.

Human-nonhuman subjectivity

Present-day strategies of addressing the extreme poverty and marginalization of the people in remote areas of the highland Andes commonly have proven ineffective and inadequate. This situation demands new ways of thinking, organizing, and doing. In order to "step outside the box" of present-day agriculture and food, we argue for an exploration of the human-nonhuman relational interactions, transactions, and transformations at the edges of development. As demonstrated in each of the projects, a population of individuals living and acting in a family and community does not become underfed and sick alone. In Northern Potosi, for example, disease and hunger is the product of centuries of socio-biological and material interactions to the point where poverty and premature death are not an isolated event, but rather an all-too-common reproduction, if unwanted, in households across the landscape.

From the work reported here, nutrition and health cannot simply be achieved by walling in nutrients or walling off an external world of pathogens and other invaders. Instead, health must be attained in and through daily living and being. As such, (ill-)health is understood as fundamentally relational – i.e., an entangled interplay among environments, pathogens, and hosts (including humans). Returning to the work of Hinchliffe et al. (2013) on the biopolitics of "infected life", the task of development for regenerative food involves less the establishment of walls or borderlines between malnourishment and nourishment and the control of infectious disease and more the enabling of socio-biological and material territories that favor health and wellbeing.

Each case presented here found untapped energy in agrobiodiversity for shaking up the present, but this potential did not rest merely in classical class-based categorizations of people's experience, as commonly depicted in the development literature. Rather, the possibility of change rested at the dynamic territorial edges of living and being in the household, on the pathways of the village, and in the hillsides. Through human-nonhuman encounters of knowledge, affect, and skill in food and agriculture, the projects diversely assembled relational biopower found in and among plants, humans, microbiology, and the landscape, thereby generating new subjective entanglements and associations.

Conclusions: the relational bio-power of seeds

According to the work presented here, progress towards more regenerative agriculture and food is not necessarily achieved through the *extensification* of experience (i.e., an outward growth or scaling in number, area, or size), but rather through the *intensification* (i.e., a "deepening" or diversification of experience) of the entities of which they are presently a part – the genetics of existing, yet largely underutilized potato varieties, the strategic use of legumes for both harvesting atmospheric nitrogen for soil fertility improvement and the consumption of fats and proteins, and novel utilizations of the surrounding institutions and social relationships in a watershed. In so doing, participants came to disrupt the notion that marginalization and poverty were, as commonly argued in the development literature and politics, the inevitable product of genetics, race, the "the capitalist system", or simply bad luck.

Each initiative pursued a unique pathway to utilizing agrobiodiversity as a high potential, self-replicating force for development. For example, in seeking to mobilize the nutritional

heterogeneity inherent in native potato varieties, Yanapai localized source of effective biofortification and addressing iron and zinc deficiencies. World Neighbors fostered the utilization of legumes to address protein and fat deficiencies while seeking to address concerns over soil fertility and degradation, and the WFP enabled conditions for the installation of a community food basket as a social innovation for "priming the pump" of direct purchasing.

For the World Neighbors' project in Northern Potosi, improving process involved the introduction of new interactive methodologies that sought to strengthen the ties and associations between the project and local practice and social dynamics. Similarly, for Yanapai in Huancavelica and WFP in Imbabura, this involved the ability to set aside technical priorities and to create or improve fit between the project and participating communities in ways that enhanced local leadership over the governance of food.

Depictions of agrobiodiversity in the scientific and development literature are inevitably partial. Experiences with project beneficiaries and the critical reflection presented here lead us to raise questions over spatial segregation between people and their agrobiodiversity, for example with regard to nutrition and the body, the body and its food, food and its genetics, soil and agriculture. For more regenerative food and agriculture, interventions must fully embrace the depth and breadth of human-nonhuman potentialities enabled (and disabled) through people's inevitable living and being in and through seeds and agrobiodiversity.

The present state of biodiversity in agriculture, food, and nutrition is not the product of local or global phenomena, but rather simultaneously each: a highly situated, though infinitely contextualized, organic encapsulation of a particular moment in life – a singularity. As a biological form, the seed is not composed of a part or whole, but rather it is composed of overlapping and penetrable entities capable of continual reproduction. In this sense, we find that seeds are fundamentally regenerative. Owning infinitely diffuse boundaries, agrobiodiversity is a potentially powerful point of entry to both understanding socio-material and biological development as it is for engaging and intervening in it. Add water, and a seed takes on a life of its own!

Discussion questions

1. How are genetic resources (i.e., seeds) part of the (re)generating forces of life?
2. How is human-seed subjectivity involved in constituting an unsustainable present, in terms of growing ill-health, social inequality, and environmental decline?
3. How do people strategically enable, through agrobiodiversity or seeds, essential relationships of health and sustainability, both within families, neighborhoods, and social networks as well as between people and their natural environments?

Note

1 For example, see: www.unicef.org/spanish/nutrition/index_24824.html.

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