

a philanthropic choice, and the sorts of actions necessary to impact systemic changes.

Another profound impact of service-learning is that, if employed properly, it asks students to reflect on their own choices and the ethical issues inherent in their choices and their impacts on the world. Heifer International serves as an interesting organization in this respect as the organization has laid out a suite of values that they consider important in each of their projects and in their donors' impacts. These "Heifer Cornerstones", which include such values as gender equity, full participation, and "sharing and caring", provide students with an immediate set of values to consider, confront, and debate. If a student decides to teach others about this organization, she must contemplate her own values and whether or not she can support the work of such an organization. If, in fact, she can, such a project can help her to clarify her own values and to identify the sorts of organizations she wishes to support. This might, in the long-run lead to important personal changes and action, including, but not limited to volunteerism, changing consumer patterns, or even future philanthropy.

Anecdotally, I think that it does. On my campus a group of students that have passed through my course have gone on to form a Heifer International Club and to participate in the Sustainability Club. These students are now leaders in the effort that established a garden on campus and have held a number of successful education campaigns and fundraising efforts to support organizations that both promote food sovereignty and are working to eradicate hunger. Some recent graduates have even made the choice to pursue internships and/or careers in which, they believe, they can more effectively impact the issues they care about. They are making the link between individual choice and systemic change and see themselves as a part of the solution in a way that would have been inconceivable to me 26 years ago.

#### Contact

Dr Dorn Van Dommelen,  
Professor of Geography,  
Department of Geography and  
Environmental Studies,  
University of Alaska  
Anchorage, USA  
[afdvd@uaa.alaska.edu](mailto:afdvd@uaa.alaska.edu)

**Prof Michiel Korthals,**  
*Wageningen University,  
The Netherlands*

## Framing Micronutrient Malnutrition and its Ethical Impacts

### What is the result of current strategies against micronutrient malnutrition?

Micronutrient malnutrition is a problem of lack of minerals and vitamins. It causes premature death, hampers normal bodily and mental functioning. More than two billion people suffer from this type of malnutrition. Current biofortification strategies can in the short term reduce the number of malnourished people but fail often in the long term because they frame the problem of micronutrient deficiency in terms of health and not in terms of both food and health. The two strategies that have been tried since the seventies, namely, supplementation (Mayer 2008) and biofortification (Clugston 2008) have had to deal with funding challenges. However, since the FAO conference in 1992, the number of people facing malnutrition has not been reduced. There are more fundamental reasons for the apparent failure to reduce not acute but structural micronutrient malnutrition. When food is medicalised, i.e., when micronutrient malnutrition is framed as a health problem, correspondingly, only health solutions are considered. This myopic view, however, ignores

other ensuing problems which are located in the fields of physiology, agriculture, sustainability, and consumer and farmer acceptance.

On the physiological side, research shows that single solutions (supplementing or fortifying crops with one or two micronutrients) do not solve the problem of malnutrition because very often micronutrients increase or decrease each other's bioavailability. For instance, the analysis of Mast et al (2009) and (Zimmermann 2007) show that malaria patients can become more ill with iron supplementation because iron promotes malaria micro-organism. Moreover, younger and older people react differently to micronutrient supplements. For example, increasing the intake of B12 in the young can have healthy effects (a deficit of B12 can lead to neurological problems like amnesia and lameness) but in the older population, higher intake of B12 can spur the growth of cancer tumours. Evidence for the often confusing collaboration or enmity of micronutrients includes the fact that high intake of Folic Acid (PMG or B11) risks that a low or insufficient level of vitamin B 12 is masked and therefore, its deficiency cannot be detected by normal biomarkers (Cuskelly 2007).

With respect to agriculture, mostly it is not taken into account just how far the targeted areas are suitable for biofortified crops. Moreover, the strategies make targeted people dependent on buying pills, sachets or biofortified seeds, which they probably cannot do their whole life. Very poor people cannot afford to buy these treatment products. Furthermore, the programs do not start with indigenous knowledge and practices of farmers. They are formulated from a technology push position. This raises distributive justice concerns. For example, just how far the biofortified crops will push out poor farmers, and will likely be accessible only to rich or commercial farmers has not been looked into carefully (Johns 2007). Finally, environmental issues like water scarcity and land resources are not taken into account.

There are two reasons behind these concerns. Firstly, innovation trajectories to produce biofortified crops are formulated as top down pipe solutions (IAASTD 2008). This top down approach is confirmed, for instance, by the recommendation in the rather positive *Report of the First External Review of the HarvestPlus Challenge Program* (2008): 'Whilst enhancement may be brought about through breeding research, in moving to deployment there will be a need to consider the whole chain from production to consumption as there are many steps at which the quality of foods can be affected either positively or negatively (p. vii; see also Johns 2007).

Secondly, the current strategies of supplementation and biofortification define the problem of malnutrition as a health problem, and use health strategies: they target one particular problem, e.g. a iodine deficiency, propose a specific micronutrient and try to increase its presence in crops without looking for long term and wider effects like sustainability. This kind of solution is a form of a drug therapy which is like what some medical researchers are doing when a health problem is diagnosed. Here, the researchers focus on the medical problem and try to cure it.

As mentioned above, malnutrition is a multi-faceted problem: physiological, agricultural, context dependent and cultural, and all these approaches should be taken together. The overall orientation of framing malnutrition as a health problem however has several severe disadvantages that express themselves in the continuation of micronutrient malnutrition or transferring the problem. Because both strategies frame malnutrition in terms of health disentangled from food (production) they run the risk of underestimating the complexity

of the problem of malnutrition. The issue is not an intentional or non-intentional mistake from the side of the scientists. The whole landscape of treatment of malnutrition is torn between the two large boxes that are used in classifying complex human body issues by national and international administrations: they are either health (belonging to WHO) or food problems (FAO). Mostly the health side wins, because it looks so much more urgent to care for health problems. Treatment of micronutrient malnutrition is therefore pulled toward the health pole.

**My suggestion towards a solution is this:**

A strategy that frames malnutrition not just as a health problem but as a health *and* food problem could have more success. It should include complexity, contrary to common scientific practice that is often directed to simplicity and analyticity. I recommend a pragmatic ethical approach. The organic, pluralistic, experimental and developmental nature of this approach would allow for a more comprehensive mosaic of social and ethical values to express themselves in dilemmas that involve sustainable agriculture, biodiversity, climate-neutral emissions, and cultural preferences of food and perceptions of risks. It would encourage often silenced voices like that of the poor to be part of the conversation (Keulartz et al 2004). From the beginning, any kind of interdisciplinary research should heed the root of malnutrition. When considering the link between food consumption and production, farmers' social contexts should be included, not only because farmers are 75% of the people facing malnutrition, but also because they provide urban people with food. Furthermore, all levels of research should focus on the really poor farmers. When biofortified seeds are targeted by research that only rich farmers can afford to buy, the reduction of the poverty gap fails. Moreover, many other types of proposals should be taken into account, like sanitation reforms, water supply, and sewage systems.

Finally and also, research strategies should include a platform that functions as an information source on the basis of studies of cases. Here, comparative narratives can also lead to helpful benchmarking of good practices of biofortification. The benchmark should include realistic targets of reduction of deficiencies. By continuously adapting interdisciplinary technologies and social and ethical aspects the platform can foster ethical bridges between different communities, contexts and practices and promote innovations that can decrease the 10/90 gap, the gap between the rich 10 percent that uses 90 percent of all resources.

The problem of malnutrition not only shows the important role of ethics in evaluating the direct impact of technological approaches to get rid of malnutrition, but also in making explicit the value laden definitions of key practices and concomitant concepts of health, food, hunger and malnutrition.

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**Contact**

Michiel Korthals, Applied  
Philosophy Group,  
Wageningen University, The  
Netherlands  
[Michiel.korthals@wur.nl](mailto:Michiel.korthals@wur.nl)

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### **Climate Change and Sustainable Development: Ethical Perspectives on Land Use and Food Production**

Climate change is one of the major framing conditions for sustainable development of agriculture and food production. This is connected to ongoing changes in and of land-use practices which are related to local, regional and global scales, often dubbed as 'glocal' situations. That characterisation also applies to the closely related land and waters use domains of forestry and fisheries.

Agricultural and food ethics and its adjacent fields need to address well known, but aggravated 'old' problems. These are, among others, desertification due to temperature increase, changing precipitation regimes, unsustainable and/or unfair land-use and water regimes, pressure on arable land due to the loss of coastal areas, soil degradation and suburban sprawl, and the strain placed on both environment and animal welfare as a consequence of a growing worldwide demand for animal products. Also the manifold socio-economic implications on justice and fairness have to be investigated from different ethical perspectives.

At the same time, however, climate change creates specific effects: There are and will be new irreversible changes of natural and anthropogenic systems. Mitigation and adaptation measures to counter or slow down climate change have already resulted in considerable changes in agri- and silvicultural land-use. This is mainly but not only due to the significant increase in growing plants for energy supply ("biofuels"). Another perspective is the purchase or long-term tenancy of arable land or of water rights in the countries of the global south by wealthy nations and by transnational enterprises.