Ecosystem Dependence of Healthy Localities, Food and People

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Ecosystems and Health

The medical diagnostic approach to health sees it as the absence of disease which is classifiable in agreed biomedical terms in accordance with conventions like ICD (International Classification of Disease) and DSM (Diagnostic and Statistical Manual of Mental Disorders, published by the American Psychiatric Association). WHO also emphasises that wellbeing is an important health dimension. From a public health viewpoint, contributors to health and wellbeing include not only genetic and biomedical factors, but also social, occupational and environmental circumstances.

Increasingly, it is recognised that, while Mendelian inheritance may predispose to certain illnesses, its understanding and relevance usually requires gene mapping and linkage, often involving SNPs or ‘single nucleotide polymorphisms’. The overwhelming determinants of health are those of personal behaviours and the environment. Gene expression itself is highly environmentally dependent on epigenetic and nutrigenomic mechanisms. Moreover, our genome is only partially eukaryotic (nuclear DNA), also comprising mitochondrial DNA (matrilineal), non-coding RNA (ncRNA) and dominantly prokaryotic (micro-organismal without nuclei) in our various microbiomes (in gut, skin, reproductive and respiratory systems). Even our eukaryotic genome is considered to have conjoint environmental endosymbiotic origins as advanced by Lyn Margulis. Not only are environmental determinants of this diverse genome likely to be underestimated, but it constitutes a continuum between us and our prevailing ecosystem past and present. From these considerations alone, we would expect that to optimise our health we would need to be attentive to our environmental connections. This is of ancestral interest, and of relevance to biological rhythms as well, most obviously with diurnal, lunar monthly and seasonal phenomena. Even more fundamentally, we now know fairly reliably from where in the cosmos most of the elements in the periodic table come that are found in living creatures, making us cosmological.

Our moment-to-moment physiology is ecological. The minimal requirement for movement, usually by walking, is to get out of bed, fetch our food and meet others for one reason or another, taking 30–40 minutes per day (1). Indeed, we know that this is about the minimum we need in the way of daily physical activity in order to have acceptable health. In the course of walking we have the opportunity to interact with nature through contact with the undergrowth and soil (rich in microorganismal life capable of transmitting information), listening to the birds, smelling the flowers, touching the leaves, feeling the breeze and, perhaps, talking with our partner and solving problems or even snacking on fresh fruits or seeds. Countless sensory inputs are experienced, for many of which there are receptors not only at the point of first contact (as with olfaction or taste), but throughout the body after assimilation. The person who does not
exercise in this way may be nature-deprived with wide-rang-
ing health implications for mental and physical health. Our biology is affected more by matrilinear than patrilin-
earity through the maternal lineage of our mitochondria, the intra-uterine environment, the acquisition of a microbiome from the maternal reproductive tract, lactation, nurturing, dependence on technologies developed initially or mostly by women (food cultivation and gardening, gathering, and cooking; textiles and clothing; language and verbal com-
munication), and by grandmaternal more than grandpaternal support when women outlive men. Nevertheless, men’s per-
sonal behaviours—eating, exercising, smoking, drinking and having a partner—which are very much environmentally
determined, matter, for not only their own health, but also their descendants. Collectively, these inputs add to our eco-
logical characteristics.

Localities
Perhaps nothing matters more for our destiny than when, where and to whom we are born. This is because historical, geographical and socio-economic factors all come into life-
long play from and even before conception. The extent to
which we can manage these circumstances depends espe-
cially on our mother’s (and grandmother’s) education, be it formal or informal, and the respect she is accorded. This will reflect community and household values and structure (2, 3). In turn, the warp and woof of our living, working and recreational arrangements will be shaped and priorities as-
signed to each.
We need livelihoods, entailing work, but not necessarily em-
ployment. Livelihoods need a community and household framework, with obligations, responsibilities and rights to have basic needs met. These include safe, adequate and nutritious food and water, shelter, clothing, warmth, per-
sonal security, education, health care, communication and essential transport. Employment begs a relationship of de-
pendency, even servitude, which, if not obtained is referred to as ‘unemployment’ with its attendant indignity. Technol-
ogy and ageing demographics encroach on employment as we have known it and create social ills which need not even-
tuate if we each had defined livelihoods. These need to be contractual within our evolving communities and with rural
to urban shifts.
Social activity is crucial to health as evidenced in several cohort studies and natural experiments. At its most basic, it plays out in families. Perhaps women achieve it better than men, but, in any case, men who live alone have appreciably shorter life expectancies than those who do not, while wom-
en are able to maintain longevity alone. It also seems that our gut microbiome, with its environmental determinants,
plays an important role in brain function, even insofar as socialisation is concerned, possibly mediated by effects on production of the pituitary hormone oxytocin (4). Perhaps this is yet another example of our ecosystem dependency
through microbial synergy.
At another level, health is enhanced by gardens and garden-
ing. This will be complex through physical work, the joy and pleasure of seeing things grow, the vision of natural beauty, aromatic smells and perfumes, the sound of birds and an-
imals, the sight of butterflies, the avoidance of noxious ma-
terials, food production and harvest, sharing produce and
flowers, involvement of others including children and elders,
contact with the soil and its microbial and insect life, the
minimisation of ‘development’ with bricks and concrete, a
place of recreation and meditation and much more.
If what our locality can offer in a sustainable, affordable, equitable and fulfilling way cannot be realised, we have had
a sufficiently resilient and adaptable biology to move and test another locality for its capacity to do so. This has re-
sulted in repeated migration over hundreds if not thousands of generations. Alternatively, we have traded with other lo-
calities to achieve mutually acceptable arrangements. Not uncommonly, we have degraded our locality, made it unin-
habitable and moved on—but now we are running out of those possibilities with asymptotic ecosystem loss. Worse,
we have fought with others to take their locality and its re-
sources from them or to enslave them to our own ends. The
quest to travel has brought its own costs as it has become
dependent on non-renewable fossil fuels for which the earth must be plundered and the travel routes irreparable scars or battle fields.
Urbanisation is proceeding apace and, with it, there is ac-
celerated ecosystem loss and degradation (5). In China, as
elsewhere, more than half the population is now urban, with
many more to follow. This presents great challenges to food
and health systems insofar as they are underwritten with
ecosystems. Not only is there ecosystem loss in the rural
sector, but also the need for replacement equivalent systems
is difficult. That said, much food production still takes place
within urban confines, and there are more and more cities,
like New York, Melbourne, Singapore and Taipei, which are
turning residual arable spaces to food production, or opening
new possibilities with vertical, storied or roof-top gardens.
Food Systems
Food systems are ecologically and health relevant at every stage from production and harvest, through transport, processing, storage, sale, packaging, food preparation and to consumption. Even though agribusiness with large-scale food production is seen as attractive to feed the many, local small-scale family farms are known to be more ecologically efficient and sustainable. We must decrease the demand for agribusiness on account of population pressure as quickly as possible through more effective family planning. This should be possible by 2050. Otherwise, the effects of ecosystem loss and associated climate change with water and food insecurity will overwhelm us. For example, it is expected that, well before 2050, warming on the Tibetan plateau will be such that all the rivers of Asia will be largely dry, affecting 2.3 billion people according to the Chinese Academy of Science. Food security will increasingly, and again, depend on individual and community knowledge and skills. As it is, we know that people who shop and cook for themselves live longer (6, 7), partly on account of the control and complex skills involved (8). Avoiding food waste is also part of the solution to food insecurity, given that 30–50% of food produced is wasted (9). Food systems which reflect health needs as articulated in Food Based Dietary Guidelines developed by the UN System are to be encouraged (2). It is becoming clear that food for health should not be overly or ultra-processed (10, 11) and that this should be a guiding principle in food choice. Food systems should be sustainable and deliver food which is affordable and nutritious as judged by its biodiversity and minimal processing. Increasingly, equity and ethical considerations will apply to an increasingly precarious and less safe food supply (12). Who will get what?

Ecosystem Health Disorders – EHDs
It is time to have a deeper appreciation of health and its disorders if we are to change the trajectory towards new and less manageable disease patterns. One way to do that is to categorise them as Ecosystem Health Disorders (EHDs) (13). These may be regarded as manifestations of Ecosystem Dys-equilibrium by way of example as follows:

- Energy Dysregulation & Body Compositional Disorders
- Food Intake Quality Disorders eg biodiversity, ultra-processing
- Sensory input disorders
- Biorhythm disorders eg sleep, eating patterns
- Contaminant disorders eg plastics, endocrine disruptors

Policy Implications
Food and health policy needs to come together in ecological terms. It needs to inform both public health and clinical practice accordingly in close cooperation with food system operatives and environmental scientists (3, 10). The time frame for this approach to be even partially effective is now narrow. Not only international and national agencies need to be involved, but so also does a citizen’s and professional network.

Summary
We are ecological creatures and depend on our locality, community and household for our health status. Our genome is shared with our environment and our evolution is one which is ecological and intergenerational. We cannot expect that our health will be optimal unless our biology, food system, surroundings and social affairs are concordant. For these reasons alone, our priorities, livelihoods and relationships must be environmentally attentive. Ecosystem damage and loss is the gravest threat to our health and survival.

Ecological People
People are inseparable from their ecosystem without biological change, usually detrimental (3). When normal food cannot be eaten we do have recourse to formulated food for survival, as with enteral nutrition, but this does not represent optimal nutrition and health. Food is more complex in its chemistry and structure, sensory significance and social connotations than formulation can represent (11). The discrete species concept is an approximation as there is an interconnectedness of all things, both animate and inanimate. We do not live alone. Our earliest Homo Sapiens sapiens ancestors did hunt and gather from one locality to another and migrated across the globe; to that extent they were and we are resilient and adaptable. But we do not know how far we can extend our environmental disassociation. The present rate of ecosystem loss places limits on our adaptive potential which are not behaving in a simple linear fashion. Sooner or later, if not now for growing numbers, ecosystem loss and degradation will prohibit human survival, unless we act swiftly.
References