The year 2015 is special on two fronts: 1) It is the International Year of Soils, which will raise awareness about the fundamental roles of soils for human life (Fig. 1); and 2) It is also the decisive year for setting sustainable development goals (SDGs) for the global community, in which soils are an integral part of the United Nations’ SDGs initiative and post-2015 agenda. An integrated strategy addressing both these fronts, as illustrated in Fig. 2, can help increase the public’s understanding and appreciation for soils. Understanding is the first step towards meaningful action and long-term improvement. At the core of this strategy is a fundamental shift in our perception of soils and an ethic for caring about soils.

Because it is so commonplace, people often overlook soils and do not find them significant enough to spend time and effort to care about and nurture. Traditionally, soils have been simply treated as dead materials and have long been taken for granted. As a result of the Industrial Revolution and a continuously increasing world population, soils have generally been treated mechanically as a medium for plant growth, often with accelerated and exhausting use for maximum agricultural productivity. Using various energy and material inputs (such as chemical fertilizers and pesticides, heavy machines, and irrigation), agriculture has been industrialized, while the internal health of soils and their sustainable use has been disregarded. In the meantime, rapid urbanization, widespread contamination, and acceleration of soil erosion have taken away finite soil resources from food production and ecosystem services, thus causing serious concerns about how to feed the projected 9 billion people by 2050 and how to avoid threats to healthy environments and qualities of life. Remarkably, soil loss or degradation remains one of the most insidious and under-acknowledged challenges in the 21st century, during which humanity needs to take sustainability seriously.

Wolfgang Haber (2009), one of the first recipients of the German Environment Prize in 1993 (the highest German award for lifetime achievements in environmental sciences), reminded us:

“We are preoccupied with fighting climate change and loss of biodiversity; but these are minor problems we could adapt to, albeit painfully, and their solution will fail if we are caught in the interrelated traps of energy, food, and land scarcity. Land and soils, finite and irreproducible resources, are the key issues we have to devote our work to, based on careful ecological information, planning, and design for proper uses and purposes.”

Soils are now recognized as the most complex biomaterials on the planet (thus Science called soils “The Final Frontier” in its 11 June 2004 special issue). Soils are alive, extremely complex, and play essential roles in food and water security, ecosystem services, climate change adaptation and mitigation, poverty alleviation, and sustainable development, as well as global environmental change and life origin and evolution on earth. Soils have been the breeding ground for the largest microbial biodiversity and huge gene pools on earth, which are all linked to soils in myriads of ways.
The living nature of soils is vital if we are to have an ethic of soils. People generally do not accept the idea that soils are living, and thus, they do not protect soils. If soils are not treated with respect and affection like a living entity, an ethical relationship with soils cannot be established and we will not have a truly harmonious relationship with soils and land. Aldo Leopold, the father of American nature conservationism, has advocated a “land ethic” and noted, “We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect” (Leopold, 1949). Native American Chief Sealth of the Suquamish Tribe also taught us: “The earth does not belong to man; man belongs to the earth ... Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself.” Therefore, it is critical to adopt an ethical attitude towards soils. As Minami (2009) discussed, the links between soils and human culture, civilization, livelihood, and health result from ethical attitudes people have about soils, as demonstrated throughout human history (e.g., Carter and Dale, 1974; Diamond, 2005; Montgomery, 2007). French Nobel Laureate Alexis Carrel said it well: “Since soil is the basis for all of human life, our only hope for a healthy world rests on re-establishing the harmony in the soil we have disrupted by our modern methods of agronomy. All of life will be either healthy or unhealthy according to the fertility (potential) of the soil” (Tomkins and Bird, 1989).

Accordingly, we suggest some fundamental shifts in our basic thinking and approach towards the use and caring of our soils—the precious gift from Mother Nature to mankind:

- **Recognizing that humans do not grow plants; rather, soils grow plants, and humans need to care and nurture soils**: Soils actually grow plants, harbor roots and microbes, and supply nutrients, water, air, and mechanical support needed for life to thrive in below- and aboveground ecosystems. Therefore, we need to take good care of soils and value soil protection. Over-reliance on chemical inputs to compensate for soil quality/health deterioration would ultimately fail, as this would lead to the “burning” of soils by heavy dose of chemicals, killing off beneficial soil microbes and other organisms, deteriorating soil structure, and increasing soil toxicity and salinity over time. The more toxins exposed to soils, the more likely it is for these toxins to negatively affect plant health and contaminate our food and water systems and ultimately harm human health;

- **Promoting better living through biology rather than pure chemistry (e.g., fertilizers) or pure physics (e.g., irrigation)**: Functioning soil ecosystems are role models for sustainable land use, where short- and long-term interests and biotic–abiotic aspects must be balanced. Rhizosphere and belowground livestock must be managed according to biology rather than nutrient levels in soils alone and/or soil moisture status alone, as food, energy, water, air, and habitat are all part of good living for plants, microbes, and animals in soils. Thus, instead of solely focusing on implementing new technologies (such as tillage machines, irrigation methods, and agrochemical applications), a more holistic strategy is needed to achieve soil health and long-term soil sustainability. The quality of food is just as important as the quantity of food, and poorly balanced nutrition and harmful ingredients in food often have their origins in soils, as Alexis Carrel and many others already noted;

- **Nurturing soil’s internal quality to maintain its health and balancing soil use for external productivity**: As soils are living systems, maintaining soil’s internal quality or health is essential for their sustained use, which can be achieved through preserving or increasing soil organic carbon, good soil aggregation, and healthy microbial communities. Organic matter is considered to be the goddess of soils, and carbon is the currency for soil fertility that provides food and energy for microbes to drive biogeochemistry in soils. Golden soil aggregates are critical to water- and nutrient-holding capacity as well as soil aeration and microbial habitats, which can be improved through adding compost, manure, residues, and/or mulch, and reducing tillage, compaction, erosion, and contamination. Soil resources have been overexploited in modern society and are vulnerable to unprecedented global change and anthropogenic threats. Nevertheless, there are many ways people can easily contribute to healthy soils via composting, minimizing pollution, reducing agrochemicals, and using ecology principles for land use planning and for smart growth;

- **Adopting a mosaic and more organic approach to farming and gardening instead of monocultures and mechanical approach**: Large-scale industrialized monocultures, supported by intensive energy and
chemical inputs, need to be adjusted by diversified productions supported by and integrated with contiguous areas providing waste retention, pollination, climate regulation, and other ecosystem services (Huxham, 2014). The principles of conservation agriculture (i.e., reduced tillage, residue retention, and crop rotation) need to be applied in the right farming context to achieve true yield increase as well as environmental protection (Pittelkow et al., 2015). Mosaics offer a meaningful sustainable intensification approach that can operate over a spectrum of scales, ranging from individual gardens to smallholder farms to large commercial operations. This mosaic approach excludes the zoning of entire regions into mono-functional units and is more resilient than techno-centric approach (which often leads to production booms followed by busts and further ecosystem degradation). Following nature’s way to farming and gardening does take more manpower, caring efforts, and patience, but it is more organic and natural, and thus will lead to eventual sustainability and reduced cost–benefit ratio from the long run.

To achieve a sustainable world, soil care must be an integral part of the land ethic (as we have ethics for people and society). Both people and the planet are integral parts of the SDGs, which require ethic and governance to be implemented (Fig. 2). Food quantity and quality, water quantity and quality, air quality and climate, human habitat and health, and energy and infrastructure (Fig. 2) are major, closely interrelated needs for human livelihood, which are all tied to soils in myriads of ways (directly or indirectly). Therefore, caring for and nurturing soils is fundamental to achieving a sustainable world. The year 2015 is a golden opportunity to raise greater awareness in global societies about the soil ethic and the new perception of soils to guide actions and policies now and in the future.

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Today, the significance and usefulness of soil education has not been emphasized nearly enough, and soil awareness is still relatively minimal. However, by educating the general public, people can take little steps to make big differences. Ultimately, by regarding soils as being “semi-living” and in need of constant care and nurture, we can better exercise our responsibility and commitment towards preserving nature and sustaining healthy soils on earth while fully establishing the soil ethic as our forefathers have taught us.

References
Huxham, M. 2014. Ecosystems are not machines. ENSIA. Winter, 36.