# *SeedCity grows!* - A community garden initiative for local waste recycling, food production and biodiversity conservation in Science City, ETH Hönggerberg

Michael Curran[1], Franziska Matter, Aurelian Jaggi, Ivelina Grozeva and Tilla Künzli
[1]Correspondence details: *email* - curran@ifu.baug.ethz.ch, *tel* - 044 633 6919

## Summary

**ETH Hönggerberg is growing. With the addition of 1000 new residents over the next two years, "Science City" will have to deal with the pervasive problems of waste disposal and food supply in a sustainable way. This project aims to re-localize and link the processes of waste management, food production and agricultural biodiversity conservation on ETH Hönggerberg. It will create a closed-loop system of local vegetable gardens of rare and endangered crop varieties fed with composted waste from the campus, and maintained by a volunteer association of students and staff. It also aims to establish a vegetable delivery scheme with organic producers in the region. The gardens will improve the aesthetics and "livability" of the campus whilst preserving biodiversity and reducing Science City's ecological footprint through direct savings and behavioural change. It will also impart practical skills in the members, catalyze a process of knowledge transfer, and above all create a living, breathing system, which will build a sense of social identity and community on campus, setting an international model for urban agriculture and conscious consumption.**

## 1. Background

ETH Zurich's official position about the future development of "Science *City*" states that the campus is "committed to an integral responsibility towards the environment in a comprehensive and long-term sense." In order to be successful, the campus will have to develop long-lasting solutions to the problems facing many contemporary cities. This includes providing physical resource such as materials, energy, and food, and reducing and processing the resulting waste. Equally important are the psychic elements that include imbuing residents, employees and students of Science City with a sense of identity, community and improving the overall "livability" of the campus.

Already adopted elements of this pledge to sustainability include mandatory Minergie-P standard for all new buildings to ensure sustainable levels of energy consumption for heating and lighting. Waste disposal remains problematic, however, as most recycling/processing is conducted off-site, creating a disconnect between individual actions that produce waste, and the potential solutions to deal with it. Recycling is also an energy intensive process that should preferably be carried out "on-site" or be avoided altogether through re-use, or by converting the

waste of one process to the feedstock for another (e.g. application of such ecological principals has given rise to the broader discipline of Industrial Ecology).

Food supply is an area where Science City is likely to rely heavily on inputs transported from distant sources, and sourced for the most part from non-seasonal, industrial monoculture. The industrial agricultural model is widely recognized as a major driver of climate change, through direct emissions, fossil based chemicals, and long-distance transport. It creates immense amounts of pollution and waste, via heavy application of agrochemicals and packaging material. It is a major driver of both "wild" and "agricultural" biodiversity loss, through habitat clearance and loss of local cultivars and crop varieties. And it is responsible for range of human health impacts (Horrigan et al. 2002). Adopting more locally-based, sustainable and closed-cycle agricultural techniques represents a pressing need of modern urban society. If ETH Zurich wishes to pursue a holistic policy on environmental sustainability and leadership, it must strengthen its commitment to build capacity in local solutions to the problems of food production and waste processing, and at the same time create a more culturally and ecologically diverse space for both human and non-human inhabitants of a growing Science City.

## 2. Project outline

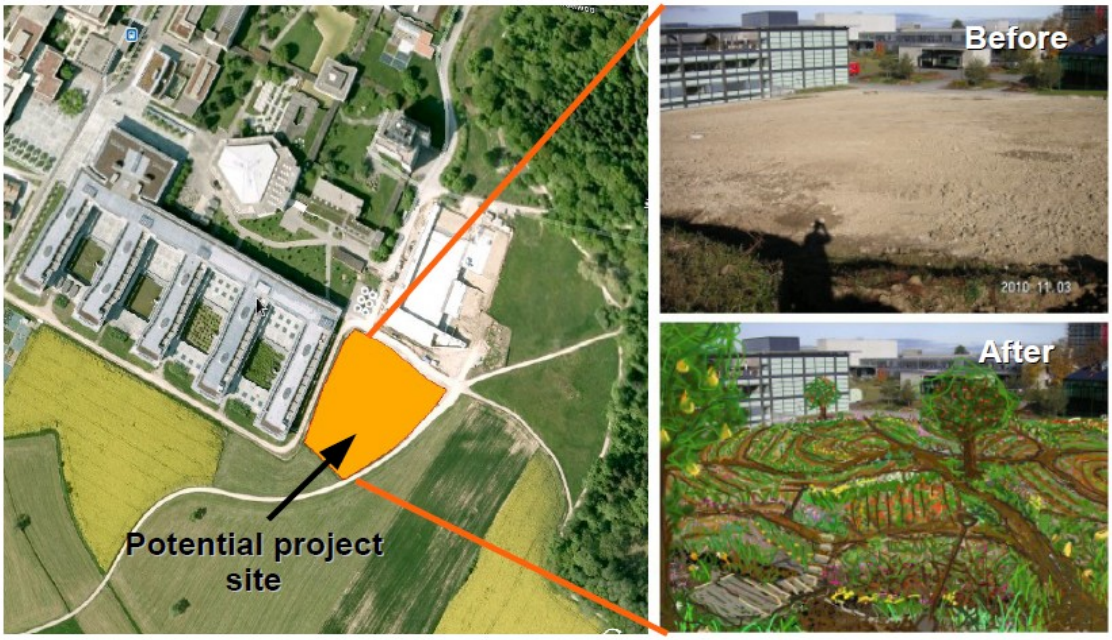
The project aims to re-localize and link the processes of waste management, food production and agricultural biodiversity conservation on ETH Hönggerberg (Figure 1). The concepts involves creating a closed-loop cycle that processes organic waste from the offices and canteens of Science City, composts this down to humus-rich topsoil, and uses this to locally produce organic fruit and vegetables of old, rare and endangered agricultural crop varieties (establishing a living bank of agricultural biodiversity). The gardens where crops are produced would be maintained and managed by volunteers from the students and staff of ETH Hönggerberg, building a sense of identity and community on campus, improving aesthetics, and impacting practical skills and knowledge to catalyse positive behavioural change. The project will also engage in scheme of community-supported-agriculture (CSA) with local food producers in and around Hönggerberg, to set up a subscription-driven vegetable delivery for the new inhabitants of the student residences. These aims, and their likely impacts are discussed in detail below.

### 2.1 Site description

The project will be located at ETH Hönggerberg on an unused plot of land spanning ca. 6400 m2 on the South-East side of the campus, bordering the sports complex (Figure 2). The land is currently unused and will be largely unaffected by the near- to long-term development and expansion of Science City.

**Figure 1. The overall project concept (see text for details).**


**Figure 2. The potential project site**



## 2.2 Local waste disposal and food provisioning

The first overarching goal of the project is to establish a local system of waste management and local food provisioning through 1) the establishment of an extensive composting and gardening system, and 2) setting up a vegetable delivery packet system with local producers around Science City. Site planning will involve splitting the area into "Zones" with the aid of external expertise in gardening and small-scale organic agriculture. Four principal zones will be established under continuous management from the project participants.

***On-site waste processing and vegetable production (Zones 1-3)***. The first zone will be a composting area where organic carbon- and nitrogen-rich waste from the canteens and offices of ETH Hönggerberg will be broken down into humus rich topsoil under a stationary system of 16 rotating large composting bins (each ca. 3.4 $m^3$ capacity). An average "hot" compost[1] has a cycle of roughly 6-8 weeks, therefore with a constant 4 bins in operation, the project will be able to process between 27 and 40 cubic meters of organic waste into humus each month (capacity may be expanded depending on the availability of labor and input material). The second zone will consist of two large Polytunnels (4m x 12m) to raise seedlings and grow warm-weather crops respectively. A small wooden shed will be erected to store equipment, and rainwater will be harvested from the outside surfaces of both Polytunnels and shed.

The third zone will consist of a large network of raised beds under various systems of management and mixed cultivation. The beds will be designed and maintained collectively by the members of the association and external consultants who will initiate the project with a series of training programmes in the autumn of 2011 and spring of 2012. A number of zero-input organic techniques will be tested, such as the GROW BIOINTENSIVE(tm) method (www.ecologyaction.com), and various green and organic mulching techniques. Perennial crops such as berries and dwarf fruit trees, and herb beds will also form part of the planting area. Crop productivity, soil dynamics (topsoil nutrient and carbon accumulation, soil chemistry etc.) and mixed culture dynamics (e.g. the effect of planting complementary neighbor species) will be monitored in collaboration with the agronomy department of ETH, and possibly facilitate Bachelor student and Semesterarbeit investigations. This will aid in monitoring project impact (elaborated in more detail below)

***Vegetable package depot (Zone 4).*** In the latter stages of project (spring 2012), a fourth zone will be established to act as a depot for a system of local vegetable packets delivered directly to ETH Hönggerberg for use by tenants of the planned student residence. This will require the future construction of a small shelter or additional Polytunnel to house the packages and will be implemented in cooperation with regional garden cooperatives such as "OrtoLoco" (www.ortoloco.ch).

[1] "Hot" composting is a batch process that requires large amounts of organic material to be available simultaneously. Because of its speed relative to "cold" composting, it is an effective method of dealing with large amount of rapidly accumulating organic material.

### 2.3 Conservation of agricultural genetic biodiversity

The second overarching goal of the project is to contribute in a meaningful way towards the conservation of biodiversity. This relates to both the contents of the gardens themselves, in terms of the crops planted, and to an educational campaign of raising support and awareness through promotional events and workshops. In collaboration with the Non-Governmental Organization "ProSpecieRara" (www.prospecierara.com), the project will use only rare, old and endangered varieties of agricultural crop plants.

***Living seedbank of biodiveristy.*** The Convention on Biological Diversity (CBD 1993) estimates that roughly 75% of agricultural genetic biodiversity has gone extinct in the past half century due to the mechanization and industrialization of agriculture, and constricting feeding habits of the global human population. Living seedbanks of agricultural biodiversity are enormously important in securing a resilient and robust food supply for the worlds population. These seedbanks consist of 1) continuously cultivating old varieties, 2) harvesting and storing seeds for subsequent years, and 3) sharing seeds with other individuals and seedbanks conducting similar activities. ProSpecieRara will provide free access to all seeds (except potatoes) and offer initial training and knowledge building to the association members in return for the function of maintaining a specified collection of important crop varieties.

***Education, research, fundraising and public events.*** ProSpecieRara and other external experts will contribute to training active members of the association through workshops organized in the autumn of 2011 and spring of 2012 when planning and preparation of the gardens will take place. The collaboration will also be extended to include fundraising opportunities such as "sponsor a seed variety" to engage the general population of Science City and raise funds to cover running costs of the project. Additional promotional events in association with the Science City canteens (e.g. custom menus of self-produced food) and the autumn market (e.g. sale of the collective produce) will ensure the project impact extends well beyond the active members and reaches into the general public's imagination.

### 2.4 Building a community of active members

The project will entail setting up a formal association (*Verein*) of active members who will commit part of their free time to establishing, maintaining and expanding the project. Membership will be open to all employees (from office cleaners to department professor) and students of ETH Zurich. The total number of members will be dependent on the interest generated by the project, the amount of labor time available per person, and the capacity (expertise) of the members, and the amount of land available on ETH Hönggerberg. As such, the association size is likely to change over time as the project proceeds.

***Structure.*** Regarding the formal structure and operation of the association, a fine balance will need to be struck between a hierarchical system that ensures active members continue to participate, and an open and free cooperative system that retains an atmosphere of experimentation, flexibility, community and self-organization. One potential model based on the social norms of mutual interest and conscious investment would be to establish a core group of (ca. 20 - 40) interested and well-trained volunteers willing to invest comparatively more time, take on more responsibilities, and act as mentors to less-experienced members. The core group

would have a larger say in the design and planning of the gardens (along with external help), and would need to meet regularly and be available to respond to the questions and needs of less-experienced members. In time, the system might take a rotational structure, with recent/less-experienced members becoming mentors and taking on more responsibility as the project proceeds and their experience grows. This would instigate a transfer of knowledge as staff and students cycle in and out of ETH Zurich, essentially self-sustaining the association. The level of public interest, and hence the potential association size, will be estimated through a series of introductory lectures and public meetings in the spring of 2011.

***Involvement and participation.*** The project will work towards building a sense of participation, identity and community for the future residents, employees and students of Science City. This will impart practical skills and knowledge and create a sense of social coherence in the association. This will be amplified by promotional activities such as involving popular ETH personalities as patrons, setting up a website, and applying mobile promotional devices (such as a mobile farming unit designed by one of the project applicants[1]; http://momourbanfarming.wordpress.com/) to broadcast the project's message of local reliance and resilience. The structure of the project will promote cooperation and shared management of a common resource. This will provide a running experiment on social economics, a form of enterprise that Nobel-prize winning social scientist and economist Elanore Ostrom refers to as lying "between the market and state (Ostrom 1994, 2009). Adopting to the social norms required for the project's success will require active communication and coordination among members, constant mobilization and promotion of the benefits, and winning over new members and guiding them through the exciting world of growing their own food. Linking the project with other prize-winning initiatives such as the Eaternity carbon footprint calculator (www.eaternity.ch), and Hönggerberg's Autumn Market will further expand its reach. Members will be promoted to think in terms of natural cycles and closed-loops, a mode of thinking that will remain long after they leave ETH. In this way the project attempts to achieve a *systemic change* in the behaviour and consciousness of the continuously changing students and staff of Science City.

## 3. Project impact

The project will make significant achievements across a range of scales and perspectives, divided into both *direct* quantifiable impacts or $CO_2$ savings, and *indirect*, knock-on effects related to behavioural change and knowledge transfer. Multiple research initiatives will be promoted with various agricultural institutions (e.g. Agromomy dept. ETH; the FIBL), to measure the multiple impacts of the project.

[1]The moMo project is a mobile module for urban farming. The system works with a micro-organism – substrate and a rainwater collector. For early planting in spring, there is a cover on the six-sided polygon module. These modules can be used singly or merged together on a field or roof deck, in courts or on urban fallow ground. It allows the inhabitants to create an urban farming environment, help increase urban biodiversity, and learn more about cultivated nature and natural cycles. With self-made gardening, urbanity gets a pleasant climate, with plants sequestering $CO_2$ and cooling down the urban „heat desert". Urban farming is a socio-cultural phenomenon aimed at growing useful plants and creating a green quality of life in cities.

***Direct impacts.*** Among the immediate, quantifiable savings in $CO_2$ emissions include displaced "food-miles" through substitution with locally produced vegetables directly from the gardens or through the vegetable packet deliveries. At good levels of productivity, the project gardens will produce the calorific requirements of ca. 13 vegetarian adults for 1 year[1]. This translates to roughly 20 t of avoided $CO_2$ emissions per year[2]. The direct emissions saving increases when local seasonal vegetable packets are included in the calculation. If half of the 1'000 future residents of Science City subscribe to the vegetable packet system, this will increase the direct avoided carbon emissions by roughly 750 t per year. Avoided transportation via reduced need to commute to the city centre will also add to these savings. Provided those same 500 people make 1 less trip to purchase groceries in Zürich centre, (and using average data on commuter numbers and $CO_2$ emissions for the ETH as a whole) the savings will increase by a further 12 t. The total avoided emissions, purely from food-mile substitution and avoided commuting, is roughly 782 t $CO_2$ per year. During the project duration, these savings will be precisely calculated in collaboration with the Eaternity carbon calculator, a previous successful applicant of EcoWorks.

During the pilot phase, the project will also process, on-site, a considerable amount of organic waste and carboniferous material, converted directly to soil and humus-rich compost. The volume of material processed will be in the range of 27 - 40 cubic meters per month (see project outline above) with potential for increased capacity following a successful pilot application. Additional avoided waste will include the packaging material from otherwise purchased vegetables and groceries.

***Indirect impacts.*** Beyond the direct savings achieved by the project, the overarching aim is to achieve a *systemic change* in behaviour by reconnecting individuals, and the Science City community as a whole, to seasonal and local food production and waste processing. The long-term effects of this behavioural shift are both difficult to quantify, and multi-faceted by nature. By imparting practical skills and instigating a knowledge transfer process, the project is likely to have a knock-on effect that resonates beyond the duration of any members involvement, and far beyond the physical borders of Science City. Through personal investment into the process of recycling and production, an individual builds an understanding of the ecological concepts that underpin nutrient cycling, biodegradability and the broader human position in nature's cycle of birth and degeneration. Recycling thus becomes a "personal need" (Hungerford and Volk 1990). Involved members are therefore more likely to apply such thinking, and the skills they learn, in their personal and professional lives during and after their time spent at ETH Zurich.

***Social well-being impacts.*** One understated but important effect of the project will the improvement to the ETH working environment. The gardens will be designed for both aesthetics and relaxation, providing a social space and outlet for excess energy that will re-balance the physical-mental work balance. Rather than desk-bound students and employees spending excess energy at the campus gym, it will be directed towards truly productive and gratifying outdoor work, complement with time to contemplate, relax and learn (undoubtedly also raising "on-the-job" productivity). As a socio-cultural experiment, the project will provide a template for

[1]According to the GROW BIOINTENSIVE$^{(tm)}$ bed system

[2]Based on an estimated vegetarian food carbon footprint of 1.5 t $CO_2$ per year.

investigations into behavioural change Linking up with the appropriate academic institutions for the purpose of research could follow a successful pilot phase of the project.

## 4. Critical factors

The most critical components to the project's success is in mobilizing the interest of students and staff of ETH, and in generating the initial interest required to kick-start the project. There will be a need for continuous and long-term investment in building and sharing knowledge, communicating effectively, group decision-making and cooperation. Initially, training the first group of members will require a large investment with a risk of loss of interest and apathy. This will need to be combated with regular meetings, workshops with professionals, social activities and some degree of good fortune. With a sufficient initial investment and successful pilot phase, the project will essentially "run itself" given continuous motivation and capacity amongst the members. For this reason, maintaining a flexible and resilient association structure will be crucial to promote participation and amplify a sense of enthusiasm and community.

## 5. Implementation

A rough schedule of activities is provided in the table below.

**Table 1. Schedule of activities**

| ***Season*** | ***Planned activities*** | ***Achievements*** |
|---|---|---|
| **Winter 2010**<br><br>Project initiation | - Arrange land, audit organic waste sources on campus;<br>- Project partners and sponsors identified, fund raising strategies;<br>- Choice of Summer 2011 promotional species;<br>- Information campaign, website launch, online promo contests (e.g. "Sponsor a variety"). | Sponsors and funding organization; core volunteer recruitment (mentors); website launch. |
| **Spring/Summer 2011**<br><br>"hands on land" | - Demonstration raised beds deployed (mobile farming modules) around campus; "Adopt a seedling" campaign;<br>- Popular ETH personalities to patronize the initiative;<br>- Public workshops with experts, weekly meetings and training, member recruitment;<br>- Pilot project with small growing area. | Introduction of project to the broader public; gradual expansion; on site activities and training. |
| **Autumn 2011**<br><br>"lend a hand" | - Demonstration beds harvest, celebration and promo events (i.e. market stall on campus);<br>- New member recruitment, choice of species for the following year;<br>- Additional land preparation for full-scale initiation of the project in 2012 (Poly-tunnels, shed erection etc);<br>- Start full scale composting of organic waste for following year. | Establishment of association structure and commitment among members; definition of goals and tasks for the following year; site preparation. |

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|---|---|---|
| **Year 2012**<br><br>Full project launch | - Management and garden maintenance by mentor-led work groups;<br>- Regular meetings and training with external experts;<br>- Quantitative monitoring of project goals (Eaternity $CO_2$ impact calculation, student research etc.);<br>- Local producers identified for vegetable packet deliveries. | Association structure evaluation; project activities up and running; vegetable delivery scheme established by end of year. |

## Costs

The project will require an initial seed budget of CHF 29'880 to cover initial equipment and building expenses, land preparation costs, training and planning expenses from external experts, promotional expenses, membership fee for the Pro SpecieRara association (see Table 2 below). Additional resources will be obtained through various collaborations. ETH Zurich will provide long-term access to land (ca. 6'500 $m^2$ potential area, to be utilized depending on demand and capacity; see section above and Figure 1); the collaborating organization Pro SpecieRara will provide the majority of seeds free of charge (subject to a annual membership fee); labour for garden maintenance, promotional work and website management will be provided through volunteer work by active members of the association (i.e. involved members of the students and staff of ETH). Any additional running costs or unforeseen expenses will be covered through donations obtained through promotional activities (e.g. "*sponsor a seed variety*").

**Table 2. Preliminary project budget**

| **Description** | **Unit price (CHF)** | **Total (CHF)** |
|---|---|---|
| **Material and equipment** | | |
| 6 x digging tool sets (shovel, spade, pitchfork, hoe, rake etc.) | 280 | 1'680 |
| 3 x wheelbarrows (110l) | 150 | 450 |
| 6 x hand tool sets (gardening gloves, hand shovel and rake, hand and hedge-clippers, seed spacers etc.) | 320 | 1'920 |
| 4 Large watering cans | 30 | 120 |
| 8 x robust garden transport bags (240 ltr) | 70 | 560 |
| 40 x wooden seed trays (0.5m x 1m) | 10 | 400 |
| 2 x large Polytunnels for seedlings and warm-climate plants (4m x 12m) | 1'250 | 2'500 |
| 16 x large compost bins (for rotation composting) | 100 | 1'600 |
| Equipment transport (5 days mobility car hire @ 100km/day with transport class) | 112 | 560 |
| Rainwater harvesting and storage tank (Ecosure 3000 Lt) | - | 630 |
| 3 x hose pipes, rolled with transport cart (50m robust, with spay nozzle) | 240 | 720 |
| Wooden shed for equipment storage | - | 990 |

| | | |
|---|---|---|
| Books and educational material (association library) | - | 500 |
| Demonstration raised beds (mobile gardening units; moMos) | 500 | 2'500 |
| Land preparation costs (e.g. digging equipment rental) | - | 2'000 |
| | | |
| **Promotion, collaboration and labour expenses** | | |
| Capacity building costs (external consults and training courses) | - | 5’000 |
| Distributional flyer and poster printing costs | - | 500 |
| Promotional equipment (material for demonstration raised bed, seed pots etc.) | - | 500 |
| ProSpecieRara membership fee (5 years, including free provision of most seeds) | 100 | 500 |
| Seed costs (certain crops only; e.g. potatoes) | - | 100 |
| 5 x Soil sample analyses | 200 | 1'000 |
| Website domain rental expenses (5 years @ 30 CHF/yr) | 30 | 150 |
| Unforeseen expenses | - | 5’000 |
| | | |
| | **Total** | **29’880** |

## References


CBD. (1993) *Convention on Biological Diversity*. Rio de Janeiro.

Hungerford, H.R. & Volk, T.L. (1990) Changing learner behavior through environmental education. *Journal of environmental education*, **21**, 8-21.

Horrigan, L., Lawrence, R.S. & Walker, P. (2002) How sustainable agriculture can address the environmental and human health harms of industrial agriculture. *Environmental Health Perspectives*, **110**, 445-456.

Ostrom, E. (2009) A general framework for analyzing sustainability of social-ecological systems. *Science*, **325**, 419.

Ostrom, E. & Institute, I.F.P.R. (1994) *Neither market nor state: Governance of common-pool resources in the twenty-first century*. IFPRI.