Using Participatory Urban Design to "Close the Nutrient Loop": A Case study from the Philippines

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A shift towards resilient cities will require more than rethinking the built form; it will require the redesign of systems to facilitate more sustainable urban living practices. "Closing the nutrient loop" is an important principle in sustainable urban design, but challenging to implement. Engaging the community in the design of such systems is therefore critical to their successful implementation.

The allotment garden concept was introduced in 2003 by the PeriUrban Vegetable Project ("PUVeP") in Cagayan de Oro City in the Southern Philippines (see UA-Magazine no. 18 and no. 20). Thanks to the support of community groups, Xavier University and local government, today there are ten allotment gardens in operation for the benefit of the urban poor. As PUVeP has also introduced composting and vermicomposting, the gardening communities are thus familiar with the benefits of using organic waste as fertiliser for food production (PUVeP, 2008).

Vegetable landing area at Agora Market
Photo: Jeanette Tramhel

Reuse of organic waste

Planning for the reuse of organic waste requires examination of the solid waste stream in the following stages: segregation (in some systems); collection; transportation; processing; and disposal or reuse. Each of these steps has to be viewed in relation to the different sources of the waste. Organic solid waste is generated roughly in two ways: it is either in bulk and segregated (such as waste from wholesale produce markets) or dispersed and unsegregated (such as waste generated by households and small-scale commercial operations). These categories require different approaches in collection and processing.

Under the conventional approach in most cities, unsegregated solid waste is collected and transported to a single centralised location. An alternative is a decentralised approach in which each district takes responsibility for its own solid waste management, from collection to processing and reuse. This is essentially the principle behind national legislation that has been introduced in the Philippines, the Ecological Solid Waste Management Act (RA 9003) and, in Cagayan de Oro City, a supporting municipal ordinance (No. 8975-2003). This legislation requires segregation, recycling and composting, and represents a shift away from the conventional practice of operating a single centralised dumpsite towards a decentralised approach with several smaller sites, referred to as Materials Recovery Facilities (MRFs). Effective implementation of this legislation requires that solid waste be segregated at its source and that several practical issues be addressed.

Participatory urban design

A participatory process was undertaken to explore these issues with selected communities in Cagayan de Oro (Barangays Lapasan, Kauswagan and Macasandig). These three "barangays" (districts) were already familiar with allotment gardens and had expressed interest in the project. The process had the support of their councils and the city administration.

Participatory urban design is based on the principle that "the environment works better if the people affected by its changes are actively involved in its creation and management instead of being treated as passive consumers" (Sanoff,

2000). Moreover, urban design is inherently an asset-based approach, given that the designer is generally encouraged "to begin with what is already there." Therefore, the approach known as Asset Based Community Development ("ABCD") was explored for its suitability as a participatory urban design tool. It was incorporated into the traditional "design charrette", which was restructured as a two-stage process that began with community consultations in each barangay, followed by a training course for a core group of selected participants.

1) Community consultations
Participants were encouraged to share their "success stories" – these could be any accomplishments, large or small, initiated by members of the community, either together or individually, related to organic waste management or urban agriculture and the community assets (i.e. skills, people, physical resources) that had been involved to achieve them. These accomplishments (or "assets") were indicated on a base map. Major sources of organic waste were identified with blue dots and existing or potential sites for urban agriculture were shown by green dots. The exercise encouraged a shift in mindset among participants towards viewing organic "waste" as a community "asset". Participants were then invited to develop a vision statement for the integration of organic solid waste management with urban agriculture in their community.

> *"After five years, Barangay Macasandig will be one of the cleanest and greenest barangays in the city with healthy people, who are orderly, peaceful, self-reliant and self-sufficient in vegetable production and root crops as a result of composting and recycling of organic waste."*
>
> *Vision Statement, July 10, 2008*

In a second consultation, participants were asked to consider and post any possible projects for the integration of organic solid waste management and urban agriculture that would help the community move towards its vision statement. The group prioritised and selected one idea as the basis for a pilot project.

2) Training of Community EcoAids
The purpose of the training course was two-fold; it served simultaneously as a design studio and as a capacity-building exercise to foster community-based environmental leadership. In each barangay, out of those who had participated in the consultations, 7-8 persons were selected who were interested in the topic and had already demonstrated leadership potential.

During the 5-day course, trainees developed a site plan for the pilot project that their own communities had chosen. This required that trainees be provided with a basic understanding of the principles behind waste segregation, the advantages of "closing the nutrient loop," the basics of composting and its use in agriculture, and the socio-economic dimensions of waste management. A session on city planning and urban design explained planning tools such as land use zoning, as well as the principles of "designing with nature" (McHarg, 1967) and creating "continuous productive urban landscapes" (Viljoen, 2005). Another session considered how the commercial sector could be engaged. These lectures were supplemented with "hands-on" exercises and field trips. All of the information gained was used in the development of the pilot projects.

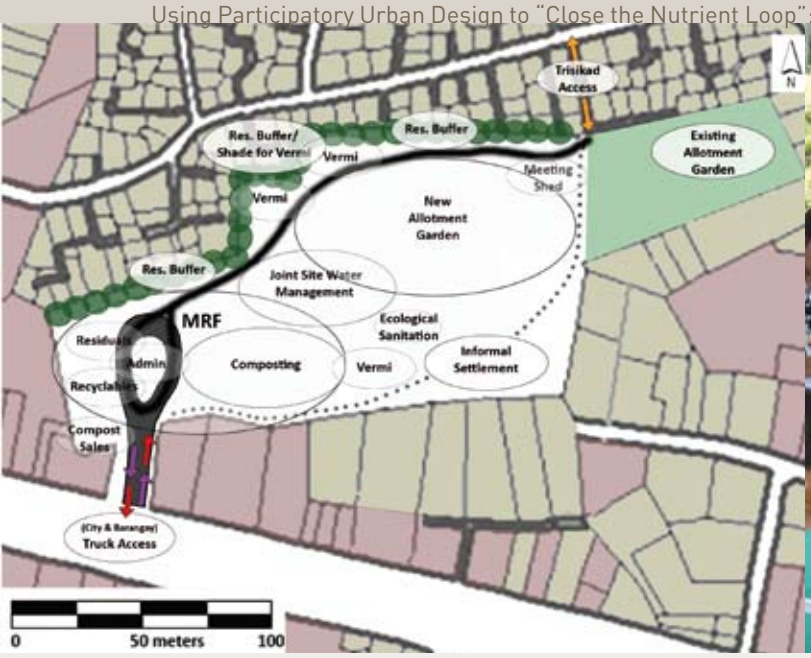
At the end of the week, final presentations were made to barangay officials and other invited guests. Each team presented its proposed pilot project to its respective barangay council. Follow-up consultations were then held in the barangays to provide an opportunity for the community to offer feedback and support for project implementation. In the months that have followed, Community EcoAids in all three barangays have started implementing elements of their project proposals.

Asset mapping in Macasandig
Photo: Jeanette Tramhel

Design proposal for Barangay Lapasan

The primary source of bulk organic solid waste in Lapasan is the Agora market and vegetable landing area (see photo). According to municipal data, it generates on average about 16 m^3 (or 9 t) of organic solid waste per day. By comparison, the unsegregated solid waste that is generated by 320 households in the pilot area would amount to only about 0.5 t per day.[1] The amount of compost that can be produced from this volume varies greatly, depending on the quality of the input material and the processing method under local conditions. Using Indonesian windrows or box composting, 3 t of organic solid waste generates about 750 kg of compost (Eawag/Sandec:2006, 34); conversion rates of 25-27 per cent for these methods seem to be the norm in most Asian countries (Waste Concern: 2007).[2]

Based on precedent studies of similar facilities, it was estimated that to process 1-3 t of organic waste per day, about 1,000 m^2 would be required.[3] A facility of that size in Lapasan could process about one third of the organic waste from the market and landing area and all of the organic waste from about 650-2000 households (or some other combination of the two sources). Based on a 25 per cent conversion rate, such a facility processing 1-3 t organic waste per day could produce 250-750 kg of compost per day (90-270 t per year).



Design concept for the site plan in Lapasan
Photo: Jeanette Tramhel

Sharing success stories in Macasandig
Photos: Jeanette Tramhel

A similar calculation can be made to determine the land area that would be required to "absorb" this amount of compost. It is estimated that, under local conditions, one ha (i.e. 10,000 m²) can absorb about 12 t of compost per year (Holmer: 2009).[4] Given that the average allotment garden is about 3,000 m², one such garden can absorb about 4 t of compost per year. Put in another way: one ha can absorb the organic solid waste generated by about 85 households, and one allotment garden (of 3,000 m²) can absorb that of about 30 households.

The site that was considered for this design proposal is a piece of vacant land that comprises about 15,000 m² in total. Its advantages include its proximity to the market and landing area, to a mill that can supply sawdust and to potential end users (producers en route to market). It also abuts an existing allotment garden and is serviced by good roads with two reasonable points of access.

The site plan that was developed for Lapasan includes an MRF (5,000 m²) with facilities to process compost, to sort recyclables and residuals, and an adjacent allotment garden (5,000 m²). As the site is intended to eventually process solid organic waste from the Agora market and landing area as well as that from households, the EcoAids had to consider suitable methods of collection and transport for the two sources. Their plan proposes that the waste from the market be collected by city vehicles along the major roads indicated in red; and that barangay trucks collect the household waste along the smaller roads indicated in purple and by tricycles along the routes indicated in yellow (see map).

The underlying principle for this urban design concept was environmental sustainability. But social and economic sustainability were also considered; the plan integrates the existing functions performed by tricycle drivers in waste collection, takes into account the sales of excess compost to offset some of the operational costs, and promotes mutual support between the MRF and adjacent gardens. As the proposal and site plan were developed as part of a capacity-building exercise, it is hoped that the "EcoAids" return to their community with skills and enthusiasm for project implementation. Ultimately, "closing the nutrient loop" will require a serious team effort and support from the entire community.

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Notes

1) This has been calculated as follows: 320 x 5 persons per household x 0.6 kg/SW per person x 50% organic matter.
2) More efficient methods will improve conversion rates; if more of the nutrient content in the organic matter is retained, the result is better-quality compost. Not only does shredding the material hasten the process, it also improves conversion; in experiments conducted at the PeriUrban Vegetable Project at Xavier University College of Agriculture, conversion rates of 67 per cent have been achieved (Holmer: 2009).
3) Box composting requires 800 m²; Indonesian windrows requires 1000 m² (Eawag/Sandec: 2006, 50). This is consistent with information from other studies and operations in other barangay.
4) This has been calculated by PUVeP as follows: A general recommendation is 2 to 4 t of compost per ha for each cropping, depending on the status of the organic matter in the soil: if the level is low, 4 t are recommended, but if satisfactory, then 2 t are adequate. As the duration of a cropping is on average 3 months, it is reasonable to expect 4 croppings per year. With an average application of 3 t per ha per cropping, 12 t of compost would be required per year per ha. This also varies with the type of crop.
5) Suggested size for an allotment garden is a minimum of 3,000-3,500 m², to enable a 300 m² plot per family (PUVeP Garden Handbook: 2008).