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Children Gardening: First Steps Towards a Sustainable Future

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Children's gardening is introduced within the broader frame of reference of sustainable development, regenerative design, and biodesign. If these fine-sounding principles accompanying the newly emerging environmental movement are to have a permanent cultural impact, it is argued that children (future consumers and participants in democracy) must interact daily with an educational environment containing a diversity of living ecosystems. Gardening in the primary grades is proposed as one of the most feasible pedagogical approaches for ensuring this type of daily learning experience, and for reversing a worrisome trend in the opposite direction. A case example of children's gardening is presented that was documented during the 1970s and early 1980s as part of a larger regenerative design project implemented on an urban schoolyard in the California Bay Area. In this case, gardening became a common thread in the process of regeneration and evolution of the habitat over many years. It was the most popular component with the teachers and the one aspect of the environmental education program that survived over the years, as the dwindling resources in public education forced the reduction or elimination of many others.

Keywords: children, gardening, sustainable development, environmental education, school

> Humanity has initiated the sixth great extinction spasm, rushing to eternity a large fraction of our fellow species in a single generation ... every scrap of biological diversity is priceless, to be learned and cherished, and never to be surrendered without a struggle.
>
> (Wilson, 1992, p. 30)

> Within a relatively short period of time, the world will have to move from a simple, highly mechanized technological base to one of great complexity, rooted in natural processes.
>
> (Lyle, 1994, p. 11)

INTRODUCTION

The environmental movement that began in the late sixties is now coming to fruition with new urgency and growing political impact. The concept of sustainable development is proving to be an acceptable collective banner. In 1987, findings of the World Commission on Environment and Development were published in *Our Common Future* (1987). In this key volume, sustainable development was defined as 'Development that meets the needs of the present without compromising the ability of the future to meet its own needs' (p. 42). As a clear value statement of the responsibility of the current generation on behalf of the future, sustainable development has begun to receive attention in the environmental design literature.[1] With added thrust from the 1992 Rio Conference, it is gaining more attention in political agendas around the world.

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Before it achieves too much political correctness and inevitably becomes co-opted by commerce (as the term 'ecology' has), two things must happen to ensure that sustainable development becomes firmly and genuinely rooted in human culture. First, the development industry must demonstrate what sustainable development means on the ground. Consumers and politicians need to *see* to understand. Second (and simultaneously), a massive reorientation of public education must occur so that a base of sustainable development values can develop in society. Designers need clients who share their sustainable development values if progress is to be made.

SUSTAINABLE DEVELOPMENT: THE NEW IMPERATIVE

Regenerative design

Lyle (1994), who brings a more comprehensive environmental design perspective to the field which embraces both architecture and landscape architecture, defines regenerative design as a principle through which design interventions must be framed to meet sustainable development values.

> 'In order to be sustainable, the supply systems for energy and materials must be continually self-renewing, or regenerative, in their operation... self-renewal can apply equally to all of the ecosystems that support... the necessities of daily life: energy, shelter, water, food, and waste processing.' (p. 10).
>
> (Surely an oversight, air is missing from the list of necessities. We assume it is added here.)

Biodesign

Speaking as a designer, a further level of principle, biodesign, is required. To make regenerative design operational, each component of the physical system must be designed to include the full range of human needs in body, mind and spirit. Biodesign focuses therefore on the architecture/landscape architecture of individual, group and community living, working, and recreating environments. Biodesign suggests that all components of the human habitat must be designed as a subsystem of the biosphere. The works of Bill Mollison (1991) best illustrate this approach.

Design, environment and culture

Lyle (1994) stresses the critical cultural role of design in the coming sustainable development revolution. For him 'Environmental design is where the earth and its processes join with human culture and behavior to create form.' (p. ix). For these new approaches to design to be effective, they must be integrated into human culture. To achieve this, the design or redesign of environments must be conducted as an educational enterprise with the participation of all those with an interest in the result, including users, clients, community organizations, governmental officers, and political representatives. As intelligent beings, humans are able to learn by trial and error, and manage the designed environment as a dynamic, open system, continuously evolving to a higher state of quality.

In this regard, the daily habitats of childhood, in neighborhood and school, are particularly significant as they are the places where the generation who must acquire sustainable development values have the possibility to learn formally, non-formally and informally through direct interaction with the elements of the biosphere. Here, the necessary base of a sustainable development culture has the best chance to evolve, with parents and teachers working in partnership with children, to shift the course of the planet in a more sustainable direction.

The problem is that in many parts of the world children are rapidly loosing contact with live nature in their daily lives. Even in rural areas television is becoming a substitute for the real thing, replacing exploration of the outdoor environment with programming that breeds violence, even towards our own species. This highly disturbing trend, promulgated also by the growing social threats towards children in the public environment, has not been more eloquently addressed than by naturalists Gary Nabhan and Stephen Trimble in the *Geography of Childhood* (1994). For them, viable childhood is becoming an endangered species.

If sustainable development values are to be created in society, we must recreate, as a matter of

great urgency, viable educational habitats for children where they are able to learn on a daily basis the lessons of nature. Gardening is clearly an effective first step.

Hands in the dirt, a first step

Some time ago, I had several years' experience with gardening in a primary school in the San Francisco Bay Area of California.[2] Gardening was part of a larger regenerative design project to renaturalize a completely desertified (asphalted) urban schoolyard and convert it into a viable natural habitat for school and neighborhood use. The Environmental Yard, or Yard project as it became known, stretched over a ten-year period from the early 70s to early 80s. The project was conducted as a cooperative effort between the University of California, Berkeley and the Berkeley School District. Much of the success of the project stemmed from a close collaboration between the author as an environmental designer/researcher and Dr Herb Wong, then principal of Washington School, who had a single minded passion to develop an interdisciplinary environmental pedagogy at the school. For him, this meant that all subject areas would be taught through the environment because of the strong motivation that all children have to explore their physical surroundings through play and to make their own discoveries. This approach ensures that children also learn about the environment.

An early discovery we made in working with the teachers was that vegetable and flower gardening was an easy way for them to initiate this pedagogical approach. Gardening made the easiest, most direct connection between indoor and outdoor learning. It also provided a wider range of teaching/learning styles than the rigid four walls of the classroom. From the earliest days, garden activities attracted more involvement from teachers than any other setting on the Yard. For children, it provided motivation for putting hands in the dirt – the most direct link to the biological processes of planet Earth.

Not a new idea

From old photographs in the school district archives we discovered that the school site had been under cultivation in the 1920s. Girls and boys were shown hoeing the ground. Behind them were animal hutches, housing possibly chickens or rabbits. A goat appeared in another picture. What had happened to those gardens? (I remembered the school garden I had labored in at the primary school I went to in England in the 1940s, and wondered if it still existed.) In California, educational priorities had apparently changed. Gardening went out of fashion and was replaced by asphalt – most likely as part of a post-WWII neat-and-tidy engineering approach to school environments implemented when the school was rebuilt in the 1950s. Our goal, now in the 1970s, was to reintroduce the natural environment as an interactive educational resource on the school site once more, with gardening as a leading strategy.

The first patch of dirt

The idea so interested the public relations director of a major San Francisco corporation that he had a couple of loads of topsoil trucked over and personally delivered packets of seeds and hand tools for the children to use. Space was set aside along classroom windows to sprout seedlings in milk cartons, yogurt, and cottage cheese containers. These small horticultural corners quickly produced results. Soon, lines of children were emerging, gently cradling seedlings ready to transplant in claims staked out along one edge of the Yard, next to an existing standard chainlink fence where a three-meter wide strip of asphalt had been removed and replaced with topsoil. Patches of marigolds, pansies, snapdragons, and daisies began to bloom, alternating with rows of the classic vegetables of a child's garden: radishes, carrots, squash, and green beans.

The initial dirt-patch gardens were hard to keep going. All irrigation water had to be carried from a single spigot on the side of the school building – a major task for young children. The best planting spots were also the best places for dirt play. This was an irresistible activity for the children and demonstrated their desire to explore the environment through play. But it was done at the expense of the garden plants.

Environmental protection

Balls from adjacent ball games also got into the gardens and seedlings were damaged inadvertently by ball players. Like intelligent farmers,

children and teachers enclosed their land. Ecology Action, a local community organization, delivered a load of used lumber and worked with classroom groups to build a fence to protect the garden strip from the adjacent kickball area. By planting close to the fence, or between the pickets where ball players couldn't tread, children discovered that plants flourished. They saw that those planted in the middle of the plot, even when protected by well-driven stakes, had less chance of survival.

In spite of their vulnerability the early gardening efforts were a first crucial step, the source of much learning, from which permanent gardens evolved . To improve irrigation efficiency, a water line was laid along the strip, with a separate spigot for each classroom plot – a big improvement. Along another chainlink fence, sections of reject sewer pipes were used to create planting beds. As these were elevated, the plants were well protected.

Figure 1. The tri-compartment compost box in full swing with university student intern / researcher in urban agriculture looking on (bottom, left), while Washington students do the hard work.

Composting

The next variable to tackle was soil quality. In the early days, soil consisted either of adobe-like clay or sandy loam trucked over from San Francisco. Both lacked organic matter and either drained too fast in the case of loam, or too slow in the case of clay. Both had the further disadvantage of becoming almost as hard as furnace-lining under the hot Californian sun. Ecology Action conducted after-school workshops where teachers made simple jam jar compost experiments that children could easily try in the classroom – an initial step in observing and understanding the decomposition process.

The second step was to construct a simple compost box on the garden strip. Measuring about one meter square and 80 cm high, it was made from four pieces of nailed and framed recycled plywood and painted by children with motifs of composting organisms. A special song written by the children with Ecology Action's help made the compost turning a special event, with everyone dancing around the box singing greetings to the worms and bacteria.

The following year, two university students replaced the primitive box with a professional, tri-compartmented upgrade. They worked on the construction closely with the children, who loved the opportunity to work with adults, creating a project together using real tools. This was an important demonstration of the value of university involvement, where adult students could provide the kind of early real life experiences that are inaccessible to many urban children now a days. And the university students had the educational benefit of being able to work on a live project with children.

One class set up a simple, controlled experiment to demonstrate the effect of compost on garden productivity. Beans were planted in three pots containing respectively dirt from the Yard, dirt from the landscaped strip in front of the school, and compost. The much faster growth rate of the beans in compost dramatically made the point.

Turning the ripening compost was a popular after-school activity. Students from the university's experimental urban horticulture facility worked several times a week with the children. The process included layering new batches of compost, soaking them down, taking the temperature of decomposition, turning the compost from one compartment to another, and marveling with the children at the heat and steam, as weeds, rabbit droppings, riding stable manure, apple cores, half-eaten sandwiches, and cafeteria waste were transformed into a rich brown humus ready for recycling into the ground. Previously, the food scraps went into the school's unpleasant-smelling 'dumpster,' and were carted off to the city's near-capacity landfill each morning. Now, by composting, they helped the healthy growth of rows of lettuce, carrot, beet and chard. By the end of the summer a huge, sprawling squash plant had

spread its great translucent leaves up and over the boundary fence.

Retention of the new hands-on learning was confirmed by one student who admitted 'Sometimes, when we don't like our sandwiches, we throw them in the bushes so they can decompose.'

Children conducted their own scientific investigations involving the steamy, compost box, as its contents were transformed into sweet smelling, ready-to-spread compost. The decomposition of an apple tucked under the top layer fascinated children, for instance, who peeked at it every few days as it changed from a hard red object to watery slush.

Other students liked the worms, eagerly fingering them, not with squeals of 'ugh', 'yuk' and 'yeck', but with comments like 'hey, I found a fat one.' A miniature model earthworm farm was made in one classroom from a gallon-sized glass pickle jar, covered with black paper to simulate darkness. The paper was removed periodically, so the children could observe the worms in their microhabitat churning away at the soil, filling it with the air that is essential to healthy plant growth. Worms were essential soil-makers, they learned, as dirt and waste material passed through the worm bodies. Seeing themselves as co-workers in the soil-making process, a group of students formed a club called 'composting agents', advertising themselves with handmade badges bearing the club emblem. Posters were made announcing, 'Recycle Your Waste!' Each noon the compost agents brought buckets of lunchtime scraps to compost.

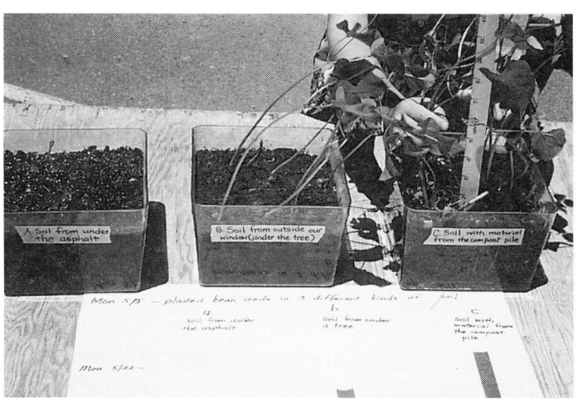

Figure 2. Science experiment to investigate the rate of growth of bean plants in three types of soil: from under the asphalt, from manicured landscape strip around the school building, and from the compost box. The differences are clearly and dramatically portrayed in graphic and live form.

Indoor connections: the 'Happy Greenhouse'

Another innovative step was an indoor gardening center set up by a landscape architecture student in a vacant classroom. To make a growing chamber, a section of recycled close-boarded fence was laid across four school desks pushed up against classroom windows. Children helped construct side frames of 2 × 4s to support shelving. The whole structure was covered with broad sheets of translucent polyethylene to create an enclosed, warm, humid microclimate within the larger space of the classroom. Children painted a colorful paper skirt around the base of the structure proclaiming 'Happy Greenhouse'.

Indoor plants and flower and vegetable seedlings soon began to flow from greenhouse to classrooms, to Yard gardens, to children's homes. University students helped the children make pressed-flower Christmas decorations to hang in windows. Terraria were constructed from one-gallon wine bottles. 'Plate gardens' were designed on old dinner plates (bought for pennies from a local thrift store). Soil, sand, rocks, sticks, dried seed heads, fungi, mosses, pieces of colored glass, aluminum foil, flower heads, petals, and small clusters of leaves were used to create miniature, imaginary landscapes. Some children brought artifacts from home: plastic animals, characters from current TV programs, and toy cars were all incorporated.

From strip to enclosure

Eventually it became clear that the valiant fencing effort along the garden strip would not provide adequate long-term protection. Classroom meetings were held to discuss the problem. Ballplayers were urged to be more careful and for a while children and teachers were hopeful that the gardens would flourish. But the plants got trampled just the same and spirits dropped to a new low. People were reluctant to abandon the investment of compost box, irrigation line and fencing, but a new site had to be found, before the gardening spirit died completely.

Figure 3. The eventual enclosed garden, with raised planting beds around the edges and in the center (wheelchair accessible). The worktable is visible in the center of the photograph. The roof of the potting shed / greenhouse is visible to the far right.

Figure 4. A group of students making daily observations and 'garden log' records in the garden.

A fenced compound across the other side of the Yard, constructed originally to store building materials and more recently turned into a temporary barnyard for the short term visit of pigs and goats,[3] became the most practical alternative. With support from a federal government environmental education grant, a team of parents and teachers converted the former pig pen into a potting shed.

To relocate the compost box, a university student work crew loosened it from its foundations. As it was lifted, a multitude of beetles, spiders, pill bugs, and salamanders scurried away, desperately searching for new shelter. Such moments were good reminders of the increased diversity and ecological interdependencies that had by now been created.

Outdoor resource teacher

The government grant enabled us to appoint a fulltime outdoor resource teacher (Tom Armour) who for several years had been the indoor resource teacher. Working out of a basement Aladdin's Cave studio, Tom had created a place where every child in the school could work with tools and materials doing hands-on projects. In this special position (with salary support culled from several sources) Tom knew all the students and had a good working relationship with the entire teaching staff.

Tom's practical experience and school-wide scope made him ideally qualified for his new outdoor job: to connect classroom groups and community resource people, to acquire printed and audio/visual curriculum material, and to find sources for tools, equipment, plants and seeds. Using the garden as his new headquarters and the whole Yard as his classroom, he coordinated the energies of teachers and community volunteers in a clearly defined indoor–outdoor educational program. All gardening groups, for instance, recorded their daily activities in 'garden logs'. `Today we tied up the peas and planted garlic; it's good for wounds. You can use it for toothpaste and to keep mosquitoes away', wrote one student after some library research. 'We found a pupa on a cabbage leaf... I like to watch the bugs eat the vegetables', noted another.

Children were encouraged to look at micro-organisms as an important part of the garden ecosystem – as creatures that needed to eat. Unfortunately, their appetites made them garden 'pests' which led to discussions about the merits and disadvantages of various methods of 'pest management': 'wash them off... pick them off... stop them from getting on the plant in first place... poison them... get something else to eat them... or just leave them alone and not be bothered by a few holes in the lettuce leaves?'

Gardens provided the most direct source of children's emotional involvement with living systems. They accommodated every stage of the learning cycle, stimulated by a diversity of flowers and vegetables, constantly changing, interacting with their surroundings, adapting to new circumstances as children counted, measured, observed, described, interpreted, and recorded different plants' growth habits – sideways, upwards, in all directions, in one direction.

Numeracy skills could be integrated naturally into almost any gardening activity. One day, a classroom group harvests a couple of their pumpkins – a large one and a small one. They have a portable scale to weigh the orange globes (which of course are intriguing objects in themselves), measure their circumferences and then measure the circumference of their own heads. The pumpkins are much bigger. They scoop out the seeds. Everyone guesses how many there are, then count them using egg carton 'counting machines' with ten sockets each and ten seeds per socket. One pumpkin has 550 seeds and the other 416. Later, they bake the seeds in the classroom and eat them.

The gardens attracted a variety of seed-eating and insect-eating birds – finches, sparrows, juncos, blackbirds, wrens, warblers, vireos, and kinglets. An exceptionally well-dressed scarecrow was constructed in an attempt to thwart the blitzes on the gardens by these energetic birds. The children recorded observations in their garden journals and drew conclusions about the influence of the scarecrow on the birds' behaviors.

Garden extensions

Although the enclosed garden became the center of activity, it is important to realize that gardening opportunities continued elsewhere on the Yard and even beyond its boundaries. The original strip garden was converted into a small orchard of fruit and nut trees. A giant planter made from split wooden utility poles was constructed on another side of the Yard's central play area. Planters made from upended sewerpipes provided flowerbeds along the boundary fence with the street and were painted to depict favorite garden animals.

A 'stack-sack wall' that had been constructed from sacks of concrete laid wet to give a freeform structure in front of the school's administrative offices, supported a south-facing planting bed along the full length of the main school building. Undulating walls created tunnels, caves and platforms for children's play, interwoven with a showy display of permanent and annual plantings – a thicket of sunflowers, for example.

Along one side of the potting shed, a lean-to bean house was built from strips of scrap lumber. After a few weeks it had turned into a shady green-veiled room dotted with scarlet runner bean flowers.

A plant propagation greenhouse was developed in an ancillary basement room with direct access to the Yard. Here, morning glory, hollyhock, passion vine, buckeye, mint, and pussy willow were duplicated from seeds and cuttings. Greenhouse seedlings became garden rows of chard, carrots, beets, and lettuce. Flowers scattered between the rows spotted the green vegetables with bright colors.

One year a parent who was a professional gardener worked with classroom groups in the twenty or so small hexagonal planting beds created at the base of each of the new Yard trees planted in the remaining areas of asphalt. Together they prepared the soil, planted annual alyssums and candy tuft, sowed wildflower seeds, and made commitments to care for the miniplots. The following year, every child in the school planted a daffodil, narcissus, crocus or grape hyacinth bulb in the same areas. Each spring bright colors punctuated the gray asphalt.

Off-site connections

Once they had gained basic gardening experience, classroom groups went on field trips to explore other garden opportunities in the neighborhood. A couple who lived just down the street had a raised-bed vegetable garden to compare to the Yard gardens. They also had chickens, and rabbits to pet, and a bee hive with tasty honey – experiences that were not available on the Yard.

On visits to the University's experimental garden, children could observe first hand innovations that broadened the concept of what a garden could be. Common house flies were trapped in a fine mesh cage, and then fed to chickens (instead of corn, thus saving a food resource that could be eaten

directly by humans). Other favorite exhibits included an experimental fish farm, beehives, a colony of rabbits, and a multitude of vegetables grown by high-yield intensive methods – with composting as an essential element.

'I liked how the chicken manure was used for fertilizer' a child wrote after one of the visits, 'it's good for the plants and helps them grow better... I liked the artichokes too [a reference to a tall stand of Jerusalem artichokes being promoted as a food source], they looked so funny.'

One day, a group returned with beautiful comfrey plants. Before long their classroom garden was punctuated with heads of delicate blue flowers and large velvety leaves ready to steep in boiling water to make a light, refreshing herb tea. Mint tea competed with comfrey as the favorite brew. Some children experimented with a 'Yard Blend' of the two. The level of interest was so strong that a project called Nature's Medicine Chest was started. A 'Healing Herb Garden' of some 15 species was designed, planted, and labeled by the children in a raised bed under the mulberry trees just outside the enclosed garden.

Gardening space was always limited. This forced a search for knowledge and ingenuity in improving soil quality; in dealing with irrigation and drainage; in understanding microclimate; in responding to seasonal cycles; and in using that scarcest of all resources, time, to the best advantage. These skills and areas of knowledge were expressed in newsletters produced by the children that contained the adventures of a cartoon character called 'Gardenman'. These communications went home to parents, along with vegetable and flower seedlings to transplant.

`It means a great deal to children to take something they have created home to their parents, 'a teacher noted in her evaluation. 'It's very educational... they're expanding the idea of ecology as something that includes people, the different ways in which we live and our future well-being on this planet'.

You are what you eat!

A major educational benefit of gardening was the development of skills in growing, buying and preparing food. Activities ranged from grocery shopping to growing vegetables, reading and writing recipes, cooking and eating, math and language, and concepts of nutritional science and health.

Classroom investigations delved into different food groups, the seasonal cycle of reproduction, the problem of keeping foods fresh and the costs of transportation. Market surveys were made at local stores to catalog commercial prices for comparison to garden-grown vegetables (potatoes, carrots, peas, snowpeas, cabbages, and radishes). Higher grade classes cataloged the countries that foods come from and researched the processes of production. It was a vivid demonstration of the interdependency of foreign markets.

'What can we do with all this food? We can't eat it all at once. How can we keep it from going bad?' Methods of food preservation and processing were explored: canning, bottling, jams, and jellies. Nuts and seeds were identified as nature's method of preservation.

An experimental 'solar dryer' (half-a-dozen slatted shelves supported on runners in a plywood box) was installed in the garden by university students. The front of the box was covered by a sheet of solar-gain plastic. Circular ventilation holes allowed air to circulate through the trays. To remove them, the back of the box slid up. The children discovered it was really easy to get quick

Figure 5. Preparing a meal in the classroom with vegetables from the garden.

tasty results with sliced apple and pineapple. Enough batches were made that even the most skeptical child was convinced that it was a workable idea. Most children knew how expensive dried apple was to buy at the store.

Vegetables were harvested to make soups and stews to accompany hotdog and marshmallow roasts over open fires. Even on uncomfortably hot summer days, children thrilled to the experience of cooking on an open fire. As shade trees grew larger and improved the microclimate, outdoor cooking became even more firmly established.

The pedagogy of gardening

Looking back, it is sobering to realize that almost 10 years elapsed between the primitive dirt-patch gardens and the first harvest from the raised beds in the enclosed garden. During that time, almost three generations of children had learned some of the many things that gardens are able to teach. In the early days they discovered how to reclaim an asphalt desert and make it productive. Pioneering parents and university students shared in this discovery, as they improved muscle tone from the heavy manual labor. They were the heroines and heroes of the gardens, whose voluntary labor made possible the creative programs and abundant harvests of later years. Eventually, a vast array of plants was available as food, for medical purposes, and to make the school environment more attractive to all its users.

Gardening was the leading edge of community participation in the development of the Yard and

Figure 6. A volunteer teacher from local environmental organization works with students in the garden.

provided evidence of progress when all else seemed to be at a standstill. Garden projects had the unique capacity to generate a collective sense of purpose through the shared experience of getting one's hands in the soil. No other activity duplicated such an intimate combination of freedom of expression and discipline. For teachers, gardening provided opportunities to connect individual personality, aesthetic expression, culture, and geography more closely than in other areas of the curriculum. In this sense, one may indeed speak of the pedagogy of gardening.

As a vehicle for interdisciplinary environmental education, gardens are unsurpassed. This is because they are a constantly changing, highly attractive, interactive, motivational setting – a fertile source of language and scientific investigation. This extract from a third grade Washington student's journal illustrates the point:

'Today we made beds out of dirt and we made paths so we can walk in the garden and not step on the plants. I got hot and sweaty. We made a map of the garden and put it on a piece of paper. We planted cabbage, carrots, peas, beets, lettuce, spinach, radishes. It was fun getting dirty. All we have to do is measure a little more and we're finished. We're going to plant some alfalfa soon because the rabbits are running out of food. Today we put up more stakes and strings... the weather is very nice, our plants are coming up... plants are growing well, the ground was 62° .We found a snail trail and put sawdust down to stop them attacking our plants. The air was very cold today, 50°... we planted onions and Jerusalem artichokes next to the fence where they will be protected. We saw some mosquito larva in the old bucket. We layered the compost with leaves, kitchen waste and rabbit droppings. We filled a whole bin! Today we transplanted lettuce, cabbage and peas and watered... we weeded, it was hard work. Yesterday Milly and I turned the compost by ourselves... it was 135,° you could see the steam like crazy. Milly flipped the compost and some bugs came out. It was hard work. Today we harvested some lettuce and peas and made a salad in the classroom and talked about different kinds of foods and made vegetable prints... I tried with a green pepper.'

Gardening is one of the most direct means through which people of all ages can acquire an awareness of themselves as part of the Earth's life

Figure 7. Investigating wildlife in the garden – a California Slender Salamander, common winter resident.

support system. The time-lapsed scale of gardens is especially attractive to children. A bean tentacle corkscrewing itself up a pole, popping flowers on all sides, transmogrifying into dangling clusters of delectable green flesh, is the kind of small scale natural event most likely to engage the curiosity of young children, and to motivate them to pursue answers to questions of 'why?' and 'how?'

The late Alan Chadwick, well-known Californian gardener and retired British Shakespearean actor once said, 'It is not the gardener that makes the garden but the garden that makes the gardener'. For us it worked both ways.

Institutional sustainability

In closing, there is an important observation to make about the institutional sustainability of gardening in the context of public education (as important as any other aspect of sustainability). The larger Yard project had to withstand many threats to its continued existence over the years, especially from the shrinking funding base of public education beginning in the late 1970s. Finding adequate human and financial resources to keep the project going in the general turmoil in public education in the 1980s was only partially successful. Much of the educational vibrancy of the earlier years dwindled (although the Yard space itself continued to be used informally). The one curricular element that did not fade was the gardening program.

To understand the Yard more clearly as an educational resource, teachers mapped the places they most frequently used for classroom work. Results showed that the Natural Resource Area was used much more heavily than other areas of the Yard and that the enclosed garden was used most of all. This result strongly supported our initial assumption about the value of natural resources as an interdisciplinary educational medium. Teachers used them more frequently even though other types of settings were available.

Year after year, the several principals who succeeded Herb Wong each managed to find the funds or to organize volunteer help from the university and other sources to keep the program going. This fact is the most convincing evidence of the moral potency that gardening carries. This, plus the fact that it is easy to define and justify educationally, gives gardening extra potential as an interdisciplinary pedagogical strategy for leading children along a sustainable development path.

ENDNOTES

1. For example, in addition to the works cited under references, see:

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2. For other aspects of this project, refer to the following:

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3. For information on this aspect, see: Moore, R. (1984). *op. cit.*

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