The Vision Ecobricks Construction Guide

An introduction to the principles, theory and techniques of building your greenest visions with bottles and ecobricks.

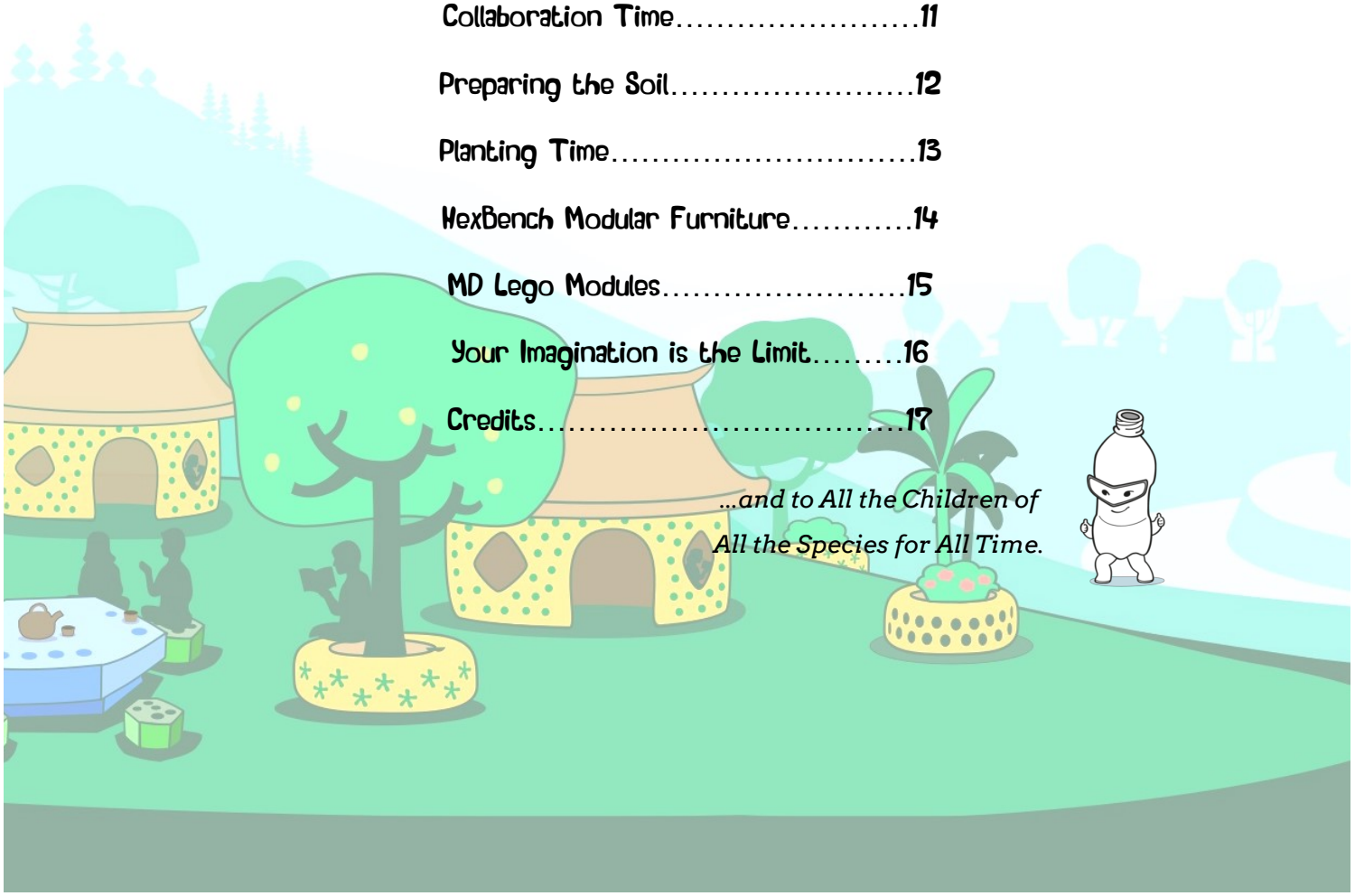
v1.0

Jan 2017
Convergence
Release

When plastics are littered, burned or dumped, they poison the Earth, Air, and Water. When we save, segregate and pack plastics into bottles, we can make building blocks that can be reused over and over again. Together we can build green spaces that enrich our community and environment.

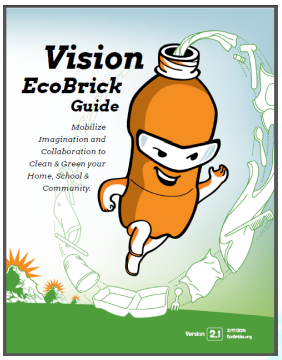
This Guide is dedicated to our Children and our Children's Children...

...and to All the Children of All the Species for All Time.



The Principles

This guide book is the follow-up companion to the **Vision Ecobrick Guide** which shows how a school, community or household can mobilize to transform their waste into Ecobricks. Once ecobricking, tangible, simple, and practical outputs are essential to keep the momentum going. In this guide you'll learn to do this and more!



The Vision Ecobrick Guide is free to download at www.Ecobricks.org

Ecobricking is a new way of construction. You don't have to hire a contractor do this stuff! There are three principles to bottle building:

1. Cradle to Cradle: *Plan for the end of your construction and the next life of your Ecobricks. Ensure that every element can return to nature or be recycled.*

2. Collaboration: *Ecobrick construction is powered by collaboration. Every element of the construction is simple enough for a child, and delegatable to an infinite amount of collaborators.*

3. Work with what you got: Use Locally Available Resources**.** *Improvisation is the name of the game with bottle building.*

Caution! *Using Cement to build with Ecobricks makes structures that when it comes to its end, cracks and ruptures Ecobricks! This means someone in the future will have a big mess to clean up.*

Green Space Collaborations

So what are you going to make with your hundreds of Ecobricks? Most likely your Ecobricks have come from hundreds of people. Let's design something they can all use and benefit from. Ecobricks are ideal for making green spaces: gardens, play parks, and what we like to call 'food forests'. Making something like this will enrich your community for a long time to come.

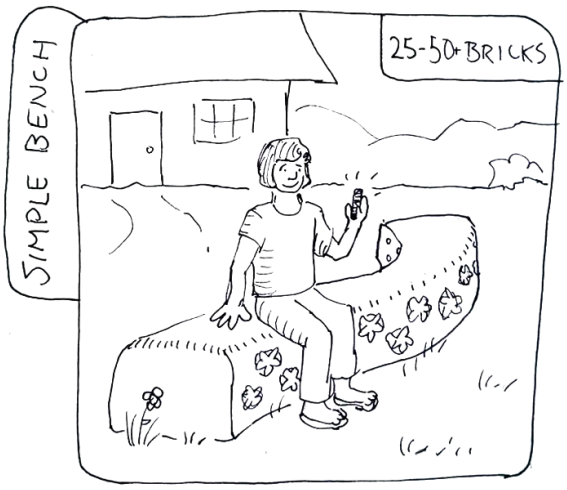
Eating healthy food is one thing. Experiencing it is another. Hands on learning to grow one's own food is *the most valuable skill* we can impart to the next generation. Self-sufficient personal and community growing is essential for preserving the Earth's biosphere for future generations.

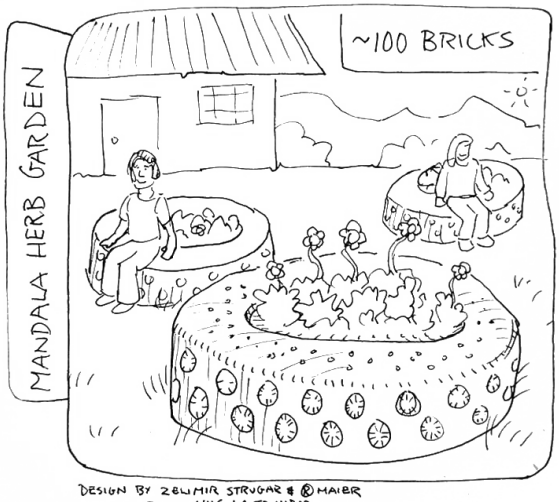
Review the Visions that your learners have made on their Ecobricks. Find an open space and allow your students to visualize how they can realize their green visions. Sketch it out. Calculate how many Ecobricks, how much sand, cement , clay, compost, soil and what plants and trees you will need. Invite and inspire the community with a bold vision! With a clear green space vision that serves all, everyone, from the students to the staff to the teachers and local politicians, will unite to make it happen.

Permaculture is widely regarded as the sustainable salvation of humanity— and an essential research topic for students.

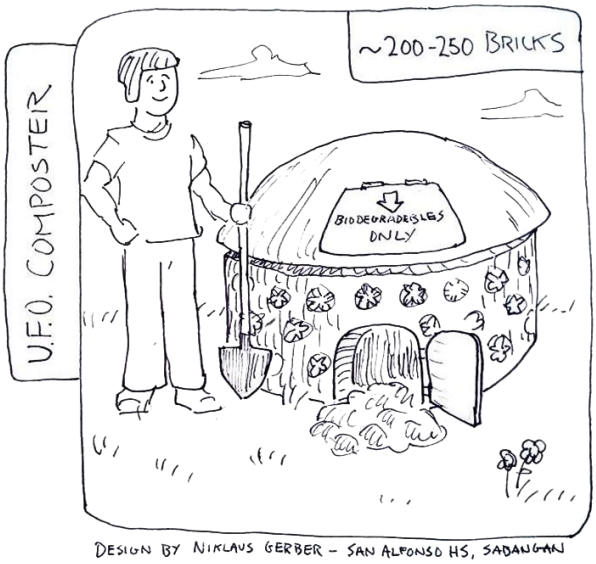
Is it dirty around your school or community? Be sure to take photos! A month after starting Ecobricks communities observe a drastic difference! Soon it will be hard to remember how it once was.

In Africa cow dung is added to cob to enchance durability, in Missouri USA, horse hair was used.

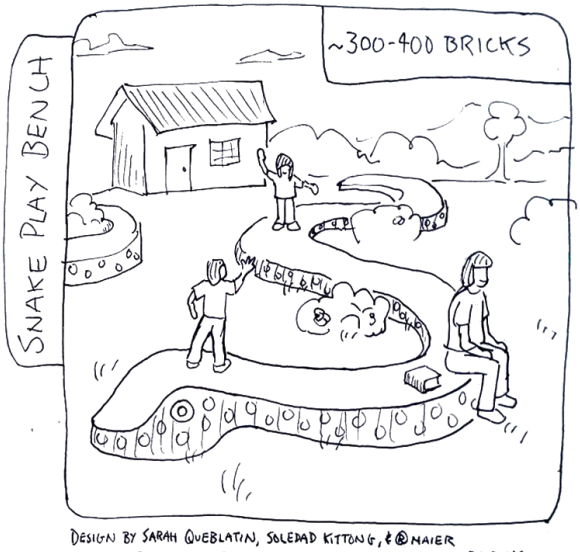




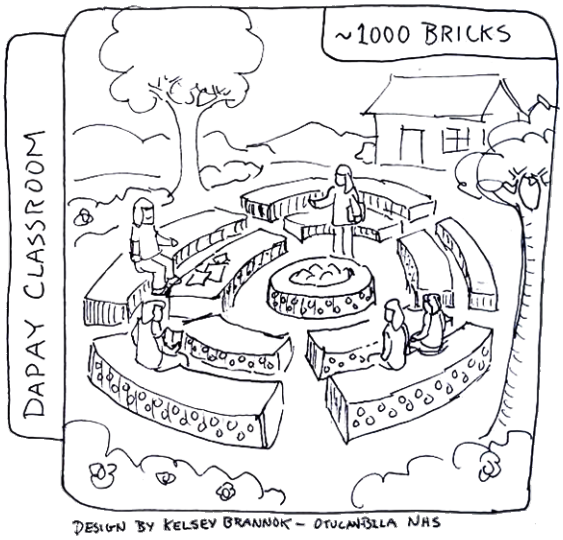
DESIGN BY ZELIMIR STRUGAR & ®MAIER
TAWANG BANIG NHS LA TRINIDAD



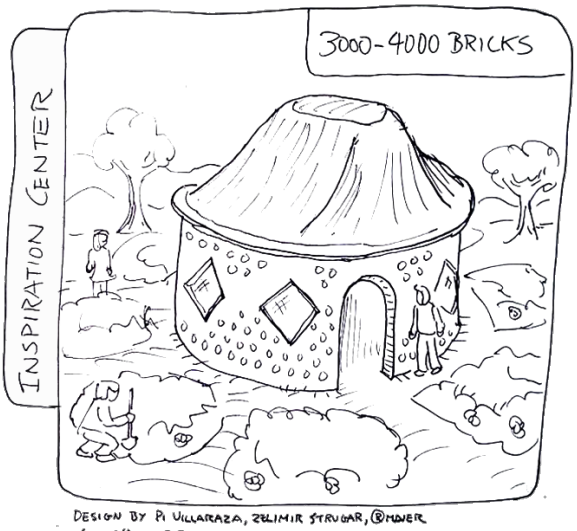
DESIGN BY NIKLAUS GERBER - SAN ALFONSO HS, SABANGAN



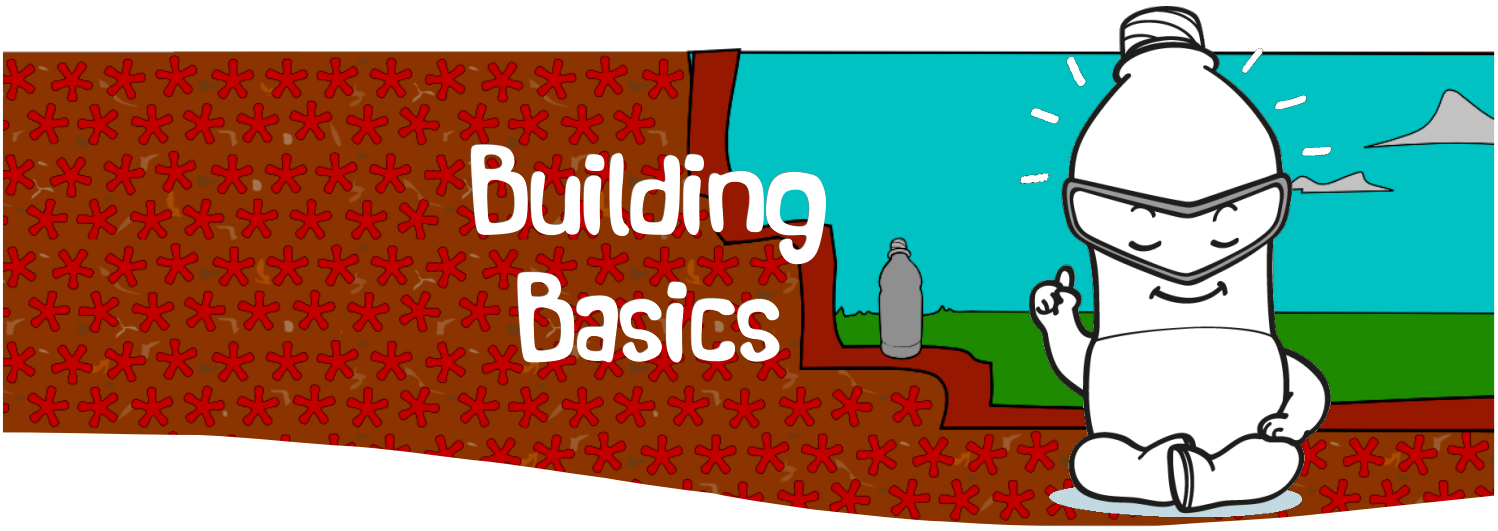
DESIGN BY SARAH QUEBLATIN, SOLEDAD KITTONG, & ®MAIER
BONTOC PROVINCIAL PLAZA, INFRONT of MULTI PURPOSE BUILDING



DESIGN BY KELSEY BRANNOK - OTUCANBILA NHS



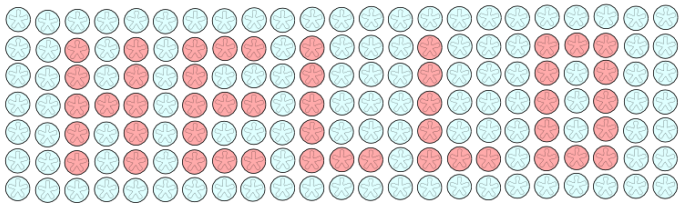
DESIGN BY Pi VILLARAZA, ZELIMIR STRUGAR, ®MAIER
- GUINA'ANG ELEMENTARY



- Use one brand or size of bottle at a time. 1.5L bottles make good benches. 600ml bottles make good raised garden beds. Smaller bottles make good walls. Using the same size of bottle per construction will keep things neat, strong and will minimize mortar.
- Make sure your Ecobricks are actually ready: use only solidly packed bottles. Ecobricks that have been damaged by rats or don't look so pretty, use for you bottom layer cement foundation.
- Simple Coke bottle bench constructions don't require steel bars. For walls over 5 layers high consider laying steel bars horizontally.
- Store Ecobricks by stacking against a wall. Segregate by color. Avoid keeping in sacks to prevent rat damage.
- Ecobricks are laid horizontally either quadratically or hexagonally. Choose the pattern that best meets your intention:

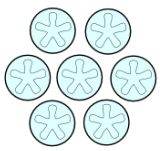
Quadratic Structure

Only four points of contact between Ecobricks. Larger spaces between bricks means more mortar required.

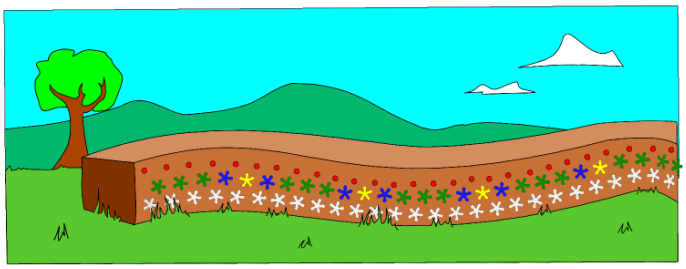


Quadratic structure works well for laying out Ecobrick pixel signs

Hexagonal Structure



Up to six points of contact between bricks. Increased strength, minimal mortar



Hexagonal Structure is best for benches and walls that maximize strength and minimize cob and cement. Use cellophanes on the bottoms of Ecobricks to make patterns.

Some schools have their students make bricks in the colors of their community's ancestral attire; others in the colors of the national flag. Benches and walls can be then made using local patterns and colors.

Did you know that Ecobricks float? Plastic is less dense than water, thus even when punctured Ecobricks are extremely buoyant. So, who will build the first Ecobrick boat?

The process of Ecobrick building is easy, inexpensive and fun. Using the ancient clay building technique of the Spanish and Igorots we can make *cob mortar*. Even elementary students can do the work using local organic resources. Because benches and playgrounds are non-structural it is a no-risk experience to learn cob building techniques.

Cob is like an organic cement. Also known as *adobe*, is an ancient building material used for millennia around the world to build enduring, livable and beautiful structures. It is made by mixing clay, sand and straw (or rice husks, or any other strong stringy binder). The red and beige clay earth found throughout the Cordilleras is ideal for cob!

We use Cob as the mortar between Ecobricks. Cob will last centuries, yet it will still crumble and release the ecobricks intact when destroyed. This is almost impossible with cement which crumbles hard and sharp— *Ecobricks will rupture before they can be extracted and one of our descendants will have an even bigger mess to clean up.*

EcoBricks are laid horizontally in cob mortar. The result is three almost three times as thick as regular cement block walls and, like centuries old Spanish constructions— solid. The mortar must cover all the ecobrick, with the optional exception of the cap's surface and bottom flower of the Ecobrick. Thus protected from UV rays and the elements the brick will last a long long time.

The making and shipping of cement creates 8% of the world's green house gas emissions. Normal cement constructions will stand for only 80-100 years. Various adobe/ cob constructions have stood for thousands of years.
Remember: *Real solutions come from a higher consciousness than the consciousness that caused the problem in the first place.*

Laying Ecobricks with Cob Mortar

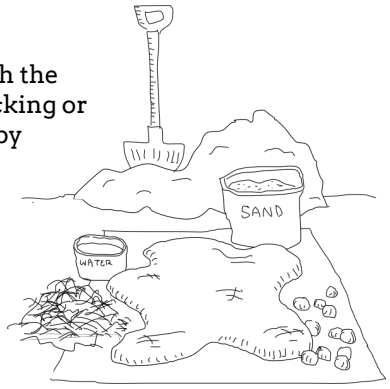
EcoBricks.org

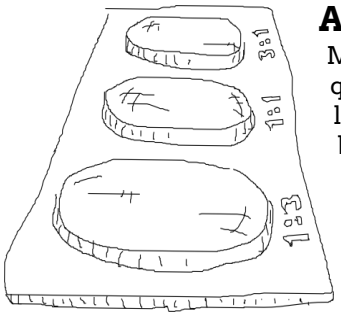
Making Cob

Cob mixes, ratios and recipes will vary dramatically from one region to another depending on the earth and locally available ingredients. Making cob is a balance between two extremes: Raw clay will crack when dried. Too much sand will crumble away. The right mixture of cob will not crack or crumble!

Simple Cob

For a simple two or three layer bench the ratio is not so important. Some cracking or crumbling will be compensated for by your outside layer of cement. This will provide the longterm structural stability and waterproofing. Go with what is available— in some places sand is easy to come by in others clay. You can safely use anywhere from 4:1 sand and clay to 1:4 sand and clay.





Advanced Cob

Make some pancakes! That' right, mix small quantities of cob with varying ratios of your local sand and clay (don't bother with the binder for this). Make pancakes of about 3cm by 15cm. Let them dry in the sun and out of the rain. After two or three days review your pancakes. Choose the ratio that doesn't crumble or crack and which is hardest to crack.

Organic Binders
Many types of stringy and dried organic materials can be used as binders in cob to increase tensile strength.

- Rice straw/stalks
- Rice hull or long saw dust
- Cocoquire or coco fibers
- Wheat Hay/Straw
- Cogon grass

Cob Balling: The Last Mix
Having your team make cob balls is a great way to ensure a good final mix of your ingredients (and put lots of eager helpers to use!). It not only involves everyone in the process, but also ensures well-mixed, precompacted and handy balls for the mortaring team.

Ecobrick Construction is designed to be powered by full participation collaboration. Everyone— from kids to adults to elders can participate. There are five categories of work. Delegate to teams. Each category is divisible to small micro-activities that just about anyone can do simultaneously.

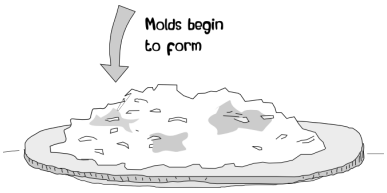
Preliminary	Design	*Student Leaders, YESO, Student Government*
	Making Ecobricks	*The whole community*
Foundation	Digging Foundation shadow	*Student Leaders involved in the design*
	Gathering and laying stones	*Young students*
	Mixing Foundation cement (8:1)	*Older students*
	Laying the Foundation cement (10cm)	*Anyone*
Cob	Mixing the cob by feet	*Young students, anyone!*
	Hand packing Cob balls	*Young students*
Mortaring	Laying the Ecobrick layers	*Student Leaders*
	Laying the cob on the Ecobricks	*Older students*
	Pounding cob even between bricks	*Young students*
Finishing	Breaking tiles to even bits	*Anyone*
	Creating the Tile Pattern on a board	*A team of older students*
	Mixing Fine Cement (6:1)	*Older students*
	Laying final cement layer	*Older students, parents, teachers*
	Laying tile pattern into cement	*Tile Team*
	Sponge cleaning of tiles and ecobricks	*Young students, anyone*

Prepare the Soil

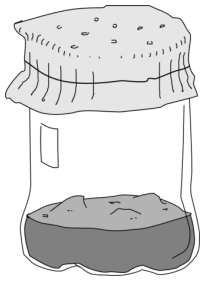
Just as important as building your garden is the preparation of the soil for your garden. You can begin long before you start laying Ecobricks. Forget the fertilizer— nature is a much better friend. Begin a compost pit. Begin collecting manure, egg shells and ash.

Soil that is rich and plant friendly is soil that is alive with micro-organisms. One of the most valuable ways to enrich your soil is by cultivating your own batch of indigenous micro-organisms. And its easy and free!

Making Your Mother IMO



Set out plate of rice in forest , garden or fresh air. Cover so that it won't be eaten by animals , nor get wet, but will be exposed to the air and collect local micro-organisms. Let sit for two or three days. Bring inside. Allow to sit for two weeks.. Collect the molds from the rice. Place into a 1.5L cut coke bottle. Fill half way with water. Place four tablespoons of molasses, moscovado or brown sugar (the darker the sugar the better). Cover bottle top with paper and an elastic (to keep the flies out, but to allow it to breathe.). Allow to sit for another week.



Using your IMO

Take a table spoon from your mother IMO. Add it to a litre of water. Shake! Sprinkle or spray on your compost, manured soil. Replenish your mother IMO every once and a while with water and sugar.

Soil Enrichers

There are many things that can be added to the soil to enrich it for plants. IMO will help beak down all of these to make their nutrient available to your plants.

- Chicken, Pig Manure
- Composted organics
- Egg shells
- IMO
- Ash from burned pa-paper/cardboard

Caution! *Do not use the soil from trash burn pits for your garden! This soil will actually make your plants grow strong, but, the plants will absorb the toxic molecules from the plastics, batteries, PVC that are poisonous to us.*

Malnourishment is major issue in schools. Due to diets of low-nutrient, high sugar foods, many students show a range of health issues from tooth decay to diabetes that prevents them from concentrating in school. By planting a range of edible, fruit, or leafy plants and herbs your garden can be munched on students. Raw fruits, leaves, and berries picked fresh are like vitamin pills– but way better! Herbs provide an easy and super healthy source of teas and garnishing for staff.

Easy Nutrient Rich Edible Plants

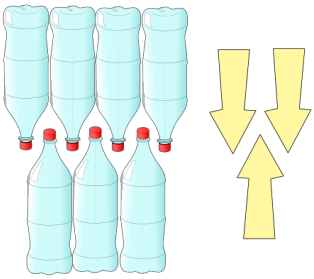
- ✔ Herbs like Stevia, Basil and Mint
- ✔ Blackberries, rasberries, strawberries
- ✔ Cherry tomatoes, sweet peppers,
- ✔ Fruit trees: Mango, guava, guyobano, etc.

Herb or Fruit Tree Circular Bench

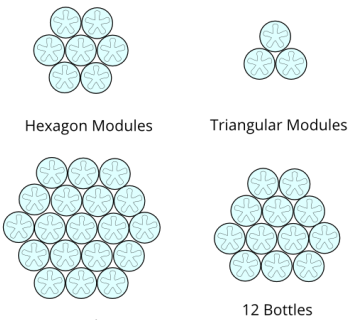
HexBench Modules

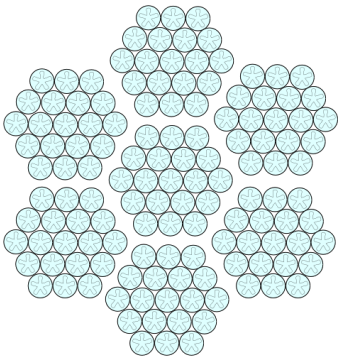
HexBench modules are the easiest Ecobrick output. Made with simple silicone sealant, they are durable, and tremendously practical indoor furniture. Modules can be used individually as seats or combined like LEGO to create tables, beds, benches and more.

Lay bottles on a perfectly flat surface. Ensure all bottles are the same size. Arrange a color pattern with caps and bottle bottoms. Silicone junction points. Press together. Let dry 24 hours.



If you have used bottles of identical brand, the hexagon module top wil fit perfectly into the triangular module bottom.





Hexagonal bench modules can be arranged to make bigger hexagonals, triangles and more!

Ecobricks should never be left outside exposed to the sun. UV rays will gradually photodegrade the plastic bottle. After only two or three years, the brittle bottle will crack and burst, releasing all our hard packed plastic!

Did you know? A Coke bottle left out in the Sahara desert sun will photodegrade into a crumbled pile of plastic particcles in only one month!

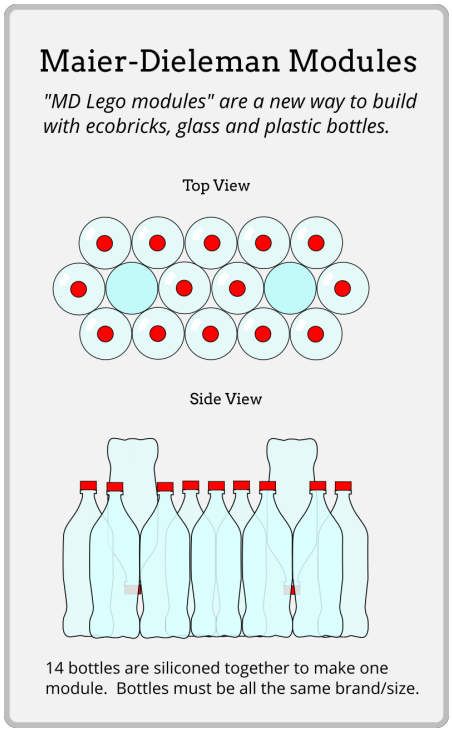
Imagine your own life-size lego blocks that can be used to build almost anything within minutes.

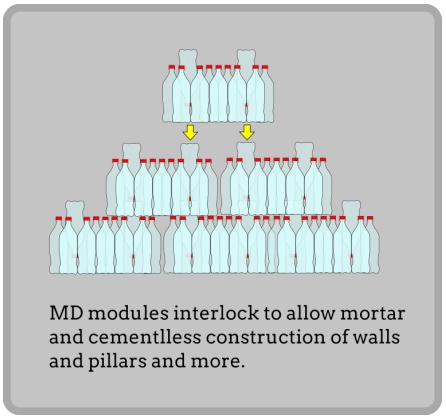
Maier-Dieleman Modules are a geometric configuration of same-brand bottles to make a lego-like module. Known as “MD Legos” for short, these modules can be arranged and interlocked horizontally and vertically. These life size lego bricks allow just about anyone to build walls and towers, castles and rocket ships, and more, within minutes. Ideal for schools and play spaces, MD’s make for a whole new world of interactive community play. Students get hands-on feel for building and team work like never before.

Ecobrickers around the world are also experimenting with making stand alone sculptures, gardens and even buildings with MD modules. You don’t have to use ecobricks, the MD geometrical formula works for glass bottles as well.

MD modules were invented by GEA principal Russell Maier with the help of Andrew Dieleman.

To create an MD module, arrange 16 Ecobricks together in the pattern shown above. We recommend the use of silicone sealant applied with a caulking gun to join plastic or glass bottles. Use a support half-cut bottle is used to suspend the peg bottle during the module make process.





With a little imagination, Ecobricks can be used for almost anything

Ecobricks can be connected using rubber tire bands, silicone, cob, and cement* to build everything from furniture, to gardens, to engineered structures. We've even seen them used as baseball bats and bowling pins. Here are some other ways the ecobricks are being used around the world.

EcoBlocks

Ecobrickers in South Africa have come up with a way to build modular units with Ecobricks. An innovation by Johanesburg architect and ecobricker Ian Domisse, these simple modules just require a plywood sheet to hold them together.

- **Pros:** Great for indoor structures, for concerts or fairs in minutes. Can be taken apart and stored fast.
- **Cons:** Cannot be directly exposed to the elements but can be plastered concealed with boarding material.

Pura Vida Atlan Construction Method

A combination of traditional post and beam concrete structure and ecobricks has been developed by the Pura Vida Atlan Ecobrick movement in Guatemala. Chicken wire is used between two concrete beams to allow the vertical stacking of ecobricks. Once the wall space has been filled with ecobricks, the wire is plastered over with cement. The construction method is tested and endorsed by Designers Without Borders, NorskForm, and INDIS. HugItForward uses this method to build schools that are subsidized by volunteer ecotourism.

- **Pros:** A great way to put lots of Ecobricks to use to build a community structure. A hybrid method between traditional construction and Ecobricks. Ecobricks can be recycled when the construction comes to its end.
- **Cons:** Uses cement, steels, and non-local materials. Results in square structures. Requires outside funding.

More applications

From baseball bats to boats, the sky is the limit on what you can use Ecobricks for!

Did you know that Ecobricks float incredibly well? We can't wait to see the first Ecobrick boats and islands. Have you seen or developed useful applications?

The Vision Ecobrick Guide began in the humble villages of the Cordilleras in the Northern Philippines where it is quite clear that plastic does not fit with the rivers, forests and fields. The guide was made possible by a small group of basureros— teachers, administrators, principals and artists passionate about keeping our water, earth, air, and bodies clean and vibrant. We all pack Ecobricks in our homes and we are joyful to see the end to the burning and dumping of what was once known as 'trash'.

Principals

Russell Maier is a regenerative designer based in Sabangan, Mt. Province, Philippines. He has been deeply inspired by the deep sustainability of the Igorot people while living in their land.

Irene Angway is a teacher turned administrator turned basurera. She is currently the Indigenous Peoples Education Coordinator of Mt. Prov.

Characters
Mr. Ecobrick & Family are designed by intrepid Manila Illustrator El Tiburon Grande. He is most passionate about projects that deal with sustainability and helps communities.

Illustrations
Joseph Stodgel founded the Trash to Treasure festivals in South Africa and directs Upcycle Santa Fe. He is passionate about building community wealth through the alchemy of 'trash'.

Translate for your region!
Does your community still have trash? We are happy to help you customize the VEB Guide for your area and language! Our team can set you up with the VEB Guide source files for translation and region contextualization. Contact us at vision@Ecobricks.org

Please share what you make!
Inspire the world! Have you made something awesome with Ecobricks? Whether it's the smallest bench or the first Ecobrick sail boat, you can help inspire others to transform their pollution in to solution. Please share it on www.**Facebook.com/ecobricks**

This booklet was made possible through people and passion— no governments, NGOs, or corporations were involved in its design.

“A problem
cannot be solved
by the same
consciousness
that generated it.”

–Albert Einstein

Join the Open Source crafting the Vision Ecobrick Guides by viting Ecobricks.org Download our guides free. Contribute your feedback and improvements to the guide. Post your Ecobrick creations. Inspire the world!

ww.Ecobricks.org