

tamalli

design led production system for
improved health and economics
in Mexico.



SCE - Parsons - product design

maryangela sanchez rocca

august 2020

index.

01_08

framework and
research

09_27

material
experimentation

28_32

modeling process

33_35

technical drawings &
material sourcing

36_37

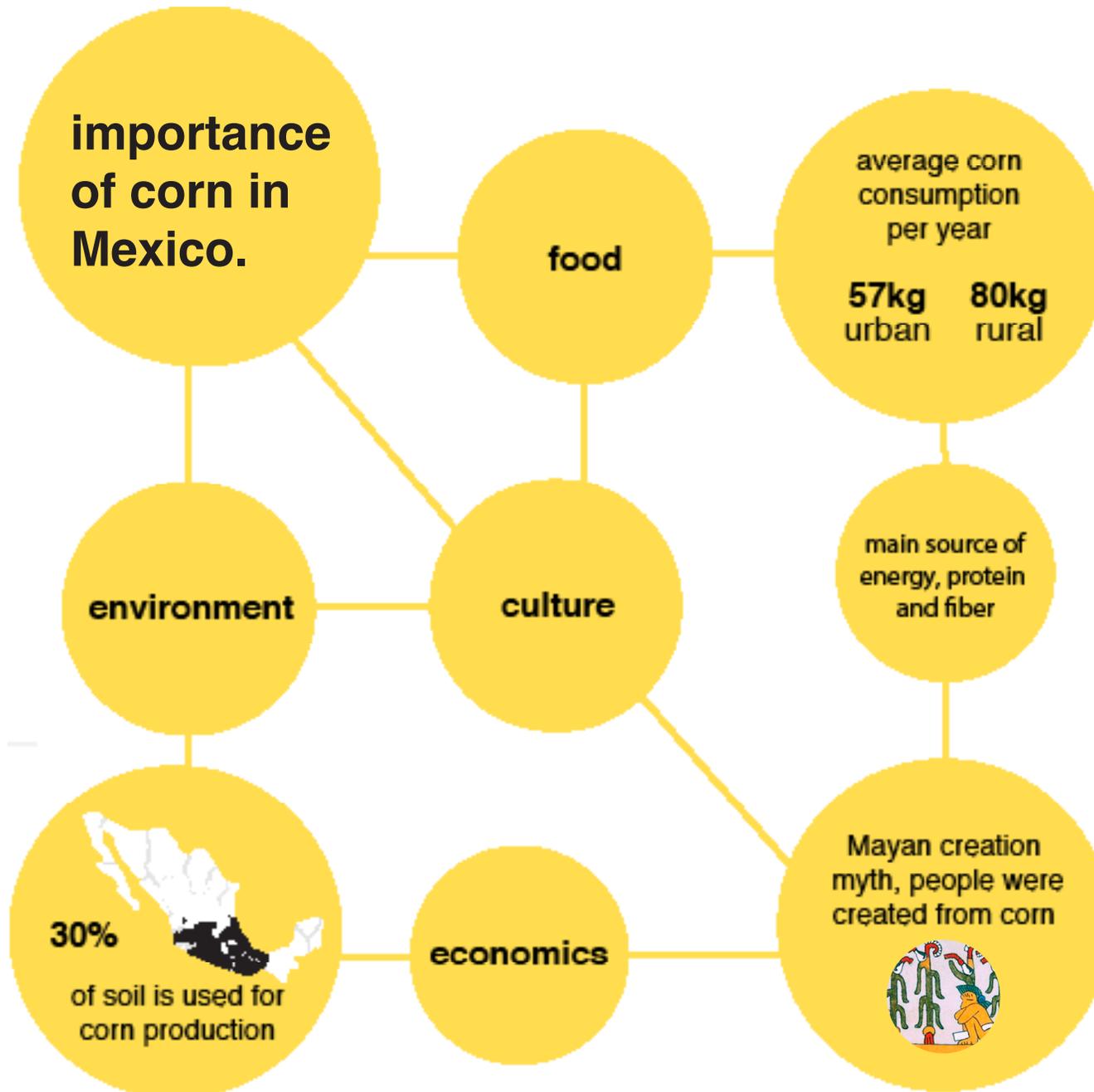
system mapping

38_39

acknowledgments &
sources

introduction.

To promote localized production of corn products and furniture in Mexico. I designed a stool for food vendors made from byproducts of corn and meat production with the purpose of replacing the promotional furniture made from plastic offered by companies like Coca-Cola, and eliminating the element of colonization from food and manufacturing.

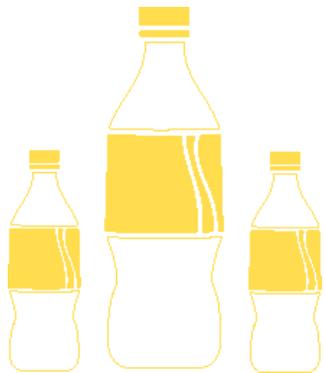


“it is the country’s main crop, meaning that if anything happens in the tortilla supply chain, it will have a huge impact in all of it’s dimensions, like health, the environment and population”

- El maíz en peligro ante los transgénicos : un análisis integral sobre el caso de México.

Álvarez-Buylla y Piñeyro, 2013.

visual indicators of colonization in Mexico.



beverage companies
want to have their
products sold.

they give promotional
furniture and objects.

they help establish
informal food businesses.

visual indicators of colonization in Mexico.

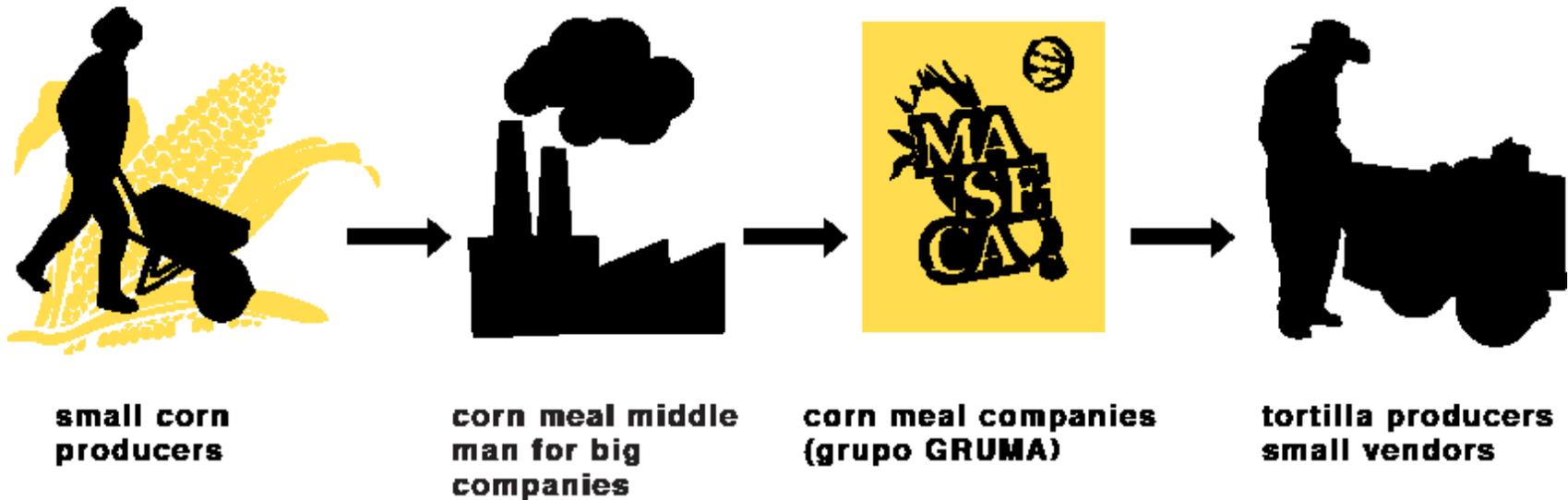


images of informal food businesses

Informal food businesses have been part of the Mexican economy since prehispanic times. Their informality is due to their lack of physical infrastructure (most of them consist of prep stations on wheels with an additional tarp or aluminum sheets as a roof and in most cases some sort of seating). Another aspect of their informality is them being an opportunity for self employment which is empowering in the way that one can start a business with low initial investment but does not guarantee a stable income or benefits. These businesses are often mentioned in the national discourse with contrary opinions of formalizing and sanitizing or keeping them the same for their cultural value and how they are affordable enough and convenient for the working classes in urban settings². Beverage companies like Coca-Cola and Pepsi offer them sponsored objects such as seating, tables, napkin holders, salt and pepper shakers, coolers, and fridges in exchange of selling their products exclusively which alleviates the infrastructure investment.

corn monopoly.

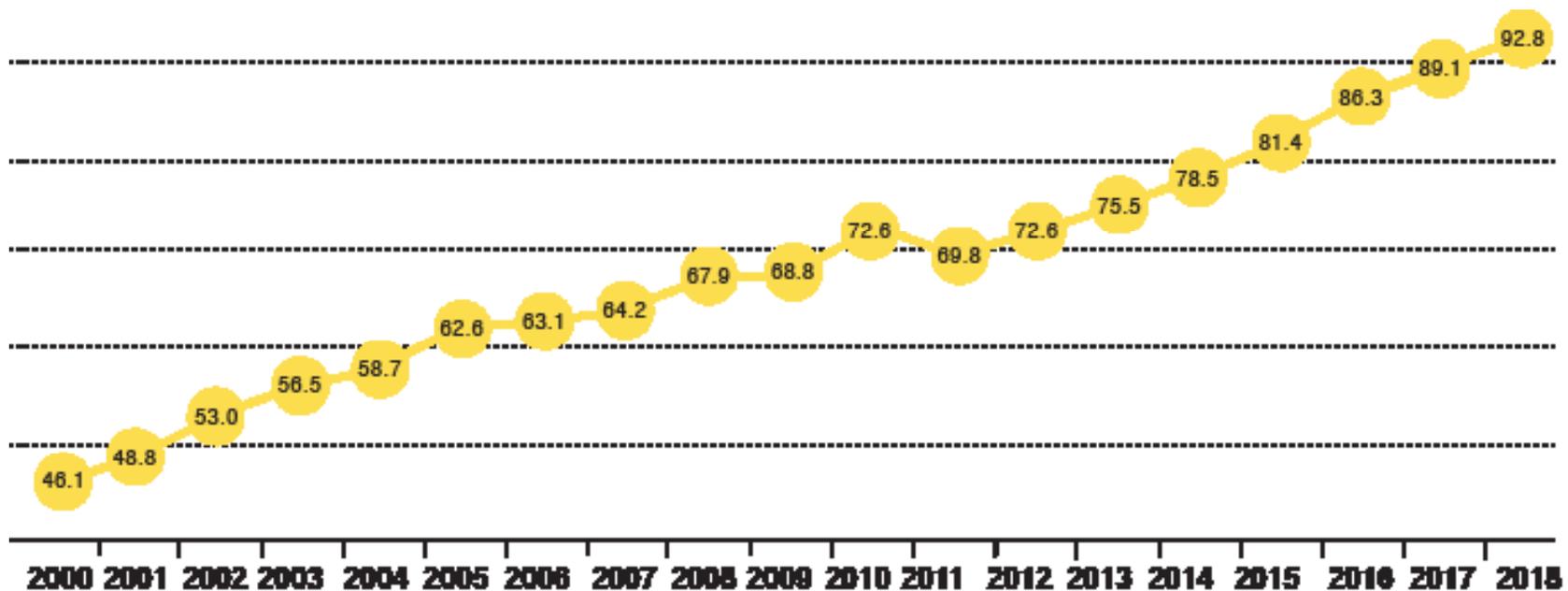
Small corn producers (that practice traditional sustainable practices) are pressured, to sell their product as fast as possible and cheap by Gruma, a Mexican multinational corn flour and tortilla manufacturer. the monopoly that controls 70% of the market³.



There is a lack of vertical integration between farmers, tortilla producers and food vendors.

impact on health.

diabetes-related mortality rate increased 101% between 2000 - 2018.



The North American Free trade Agreement NAFTA, was introduced in 1994 to eliminate barriers for agricultural and manufacturing services. In reality, the only thing Mexico got out of NAFTA was an influx of unhealthy, over processed food from the U.S. This has caused health issues in the population parallel with the decline of the traditional diet the cases of obesity and diabetes are increasing in Mexico “In 1980, seven percent of Mexicans were obese, but this number tripled to 20,3 percent in 2016” diabetes is now the main cause of death in Mexico⁴.

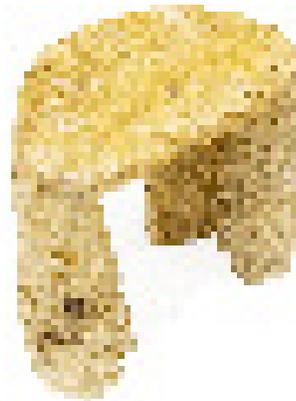
**material
experimentation.**



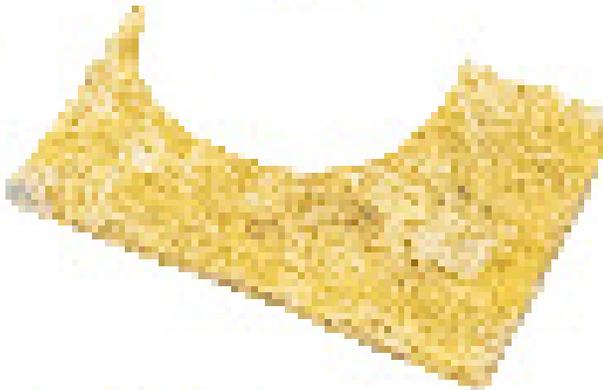
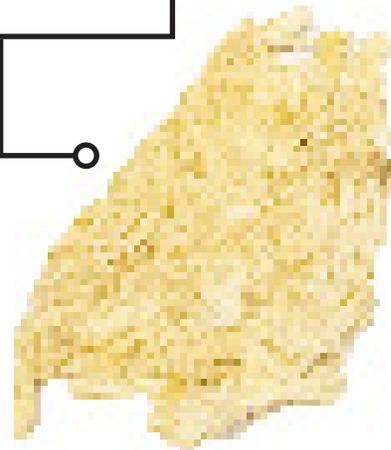
whole corn husks and wheat-paste compressed in a vacuum bag



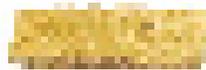
woven corn husks and wheat paste



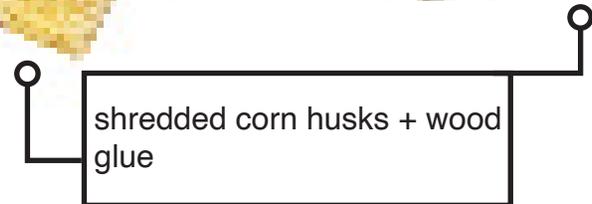
shredded corn husks and wheat paste



corn husks fiber + pine resin + beeswax compressed into a sheet



shredded corn husks + wood glue





1/4 scale prototype made from compressed corn husks and 20% beeswax and 80% pine resin in the shape of a semi column held under 60 kilos.

full scale leg prototype could support 60 kilos. uses wood glue as a binder.



appearance model made from wood covered in corn husks and beeswax and pine resin as a binder, with solid column legs angled for stackability.

con: both pressure and heat needed to form parts, not suitable for on site production with simple machinery.



finding the right binder.



pros: strong, vegan, dries fast.

cons: needs heat and pressure, activated by body heat.



pros: made from the same plant, easy to reproduce.

cons: needs many layers to be strong, needs heat and pressure to dry.



pros: quick gelling time, strong, reversible, no extra machinery to dry

cons: protein based, bad smell.

hide glue samples



20% ground hide glue + 80%
ground corn husks



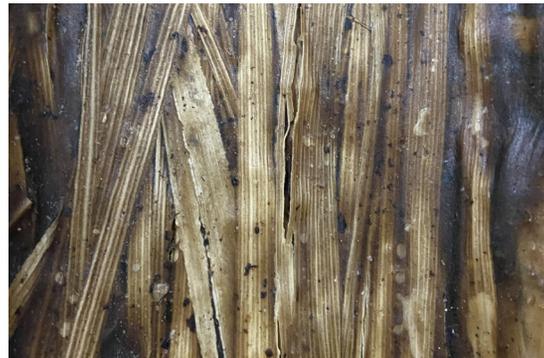
50% ground hide glue + 50%
ground corn husks and whole husks



10% ground hide glue + 90% ground
corn husks and whole husks
casted flat then bent



20% ground hide glue + 80%
burnt ground corn husks



20% ground hide glue + 80% whole
husks



20% ground hide glue + 80% ground
corn husks + corn husk ashes

molding experimentation

The molding process tries to use the least amount of material for a mold and takes advantage of the quick gelling time of hide glue.



1/4 scale mold



bent 1/4 scale model hide glue and ground corn husks

molding experimentation.

1/4 scale model made from ground 80%
corn husks to 20% hide glue.
it was able to support 60 kilos.



molding process.

I switched to hide glue in cake form to speed up the process but it ended up not drying.

The first two attempts at a full scale prototype failed. Because of the pandemic I could not get more glue.

I discovered that the material could be re-cast if I added water and boiled it at 350 degrees fahrenheit.



glue and corn husks in flat mold.



once glue congeals, legs are bent and are supported by metal tray.



failed molding attempt, glue never cured

fibers as reinforcement.

I added 4 layers of jute burlap use for produce sacks and landscaping. This gave my experimental pieces much better structural integrity. it also made the stool lighter and allowed for a faster curing time.



layers of jute and corn mixture are alternated in mold.



sample of leg that proved structural integrity.



once it semi-cured piece was able to stand on it's own and support weight.

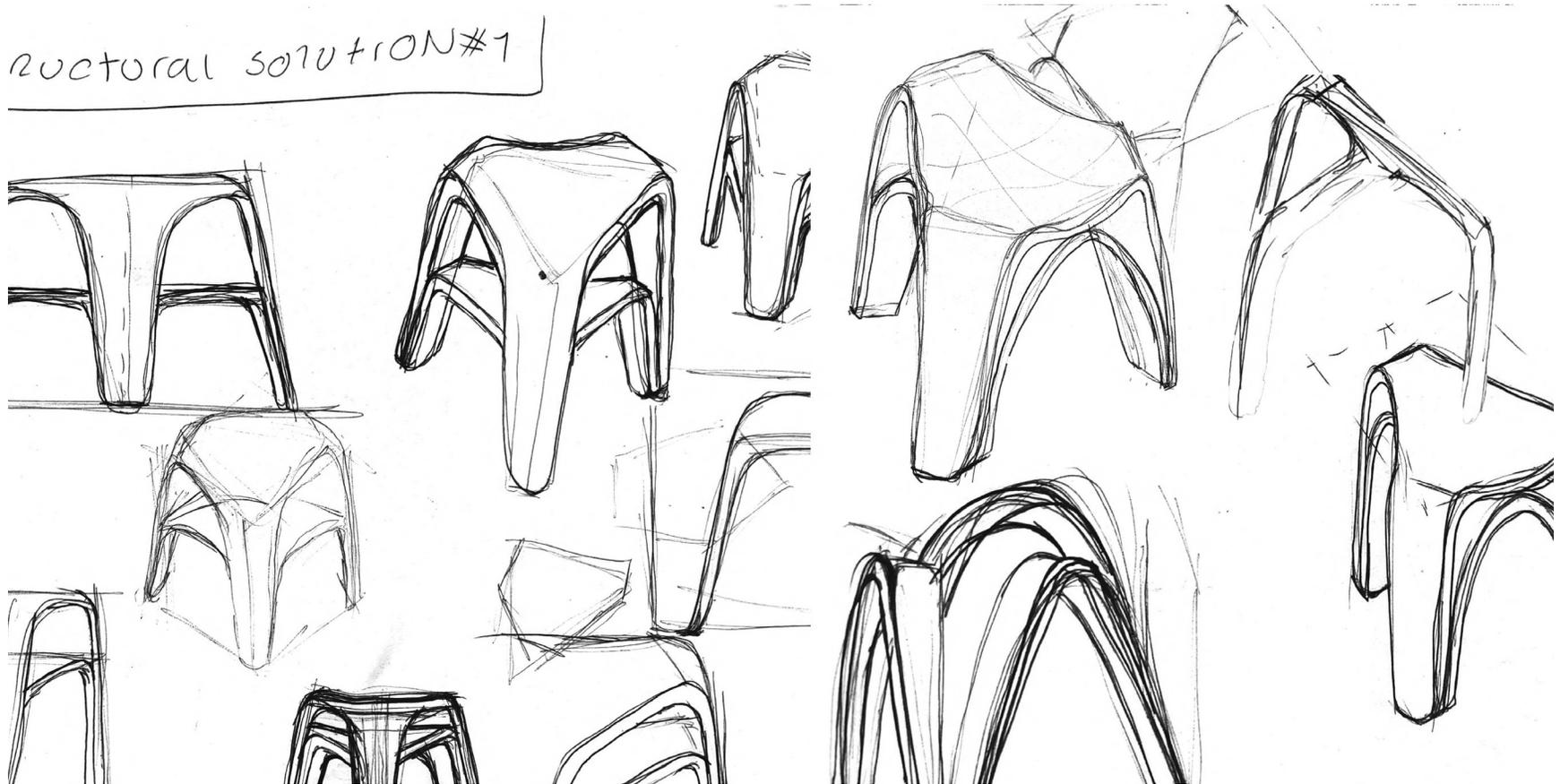
full scale modeling.



the first iteration of the fullscale prototype turned out heavier than expected and needed a suport structure that relies on compression to keep the legs from opening and the seat from sinking lower

sketches.

structural solution #1



creating lightweight supports.



20% ground hide glue + 80% ground corn husks + corn husk ashes



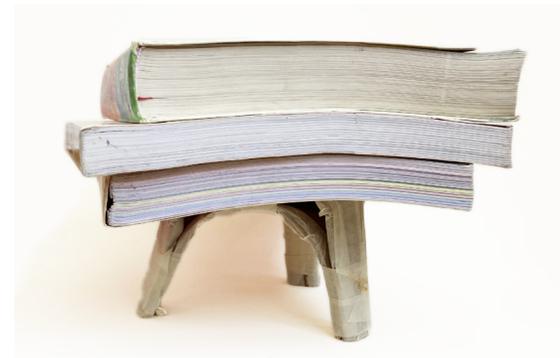
1/4 scale model thin support strips



bends after 10 lbs



1/4 scale model full support



can take 10 lbs

color samples.



cochineal dye
on burlap



cochineal dye
on muslin



bean dye
on corn husk
(turned pink because of
the sulfur used to treat the
husks)



cochineal
on corn husk
(turned red because of
the sulfur used to treat the
husks)



the blue sample was produced by just black beans, the purple was produced by adding vinegar and the green comes from adding baking soda.

color samples.



cochineal and black bean samples with a lime base.

from my previous experimentations with cochineal which yielded to more of a tint that faded after being exposed to rain for a week.

I did research on natural paints and fresco techniques where i learned that hide glue was acting as a binder but I needed a white base to achieve a saturated color.



it turned out that the addition of lime shifted the ph of the cochineal shifting the color from a carmine to a bright purple. and made the bean dye disappear.

color samples.



preparation of pigment paste.

since the black bean dye did not translate well as a pigments and color range with cochineal was limited. I decided to try anatto seeds. used as a seasoning and as a pigment in manuscript painting in ancient Mexico it yields colors ranging from burgundy to pale orange.



anatto seeds.

color samples.

the colors coming from the plant and insect based pigments are more muted and earthy. I still would like to investigate non mineral pigment alternatives that can be easilly obtained within the production chain of the other materials. the most sucessful binder and base mix was calcium carbonate and hide glue.



range of annate, cochineal and bean colors on lighter and darker material samples.



finish samples.

I let the first fullscale sample be exposed to the rain and elements for a month. it started to decay after a strong storm and proceeded to completely dry after a week. I realized that it needed some sort of protective layer to make it more water repellent. I experimented with glair (whipped egg whites that are left to age over night used to seal frescoes) it started to smell adter a week. I tried a mixture of pine resin, beeswax and linseed oil which resulted the most impermeable when the ratio of beeswax and linseed oil were smaller. to improve the texture the finish was polished with fine grit sandpaper to achieve a smooth surface.



30% beeswax + 10% linseed oil + 60% pine resin (too waxy to the touch)



20% beeswax + 10% linseed oil + 70% pine resin (smoother and more water repellent).



polished finish.

form exploration.



once I figured out the molding process this was the first form that resulted



after doing the first full scale tests, I realized that the legs were going to need a cross brace



I decided to taper the legs to use less material and make the piece lighter



the stool form was streamlined further to create a lighter piece. the curvature of the seat that is caused by gravity.

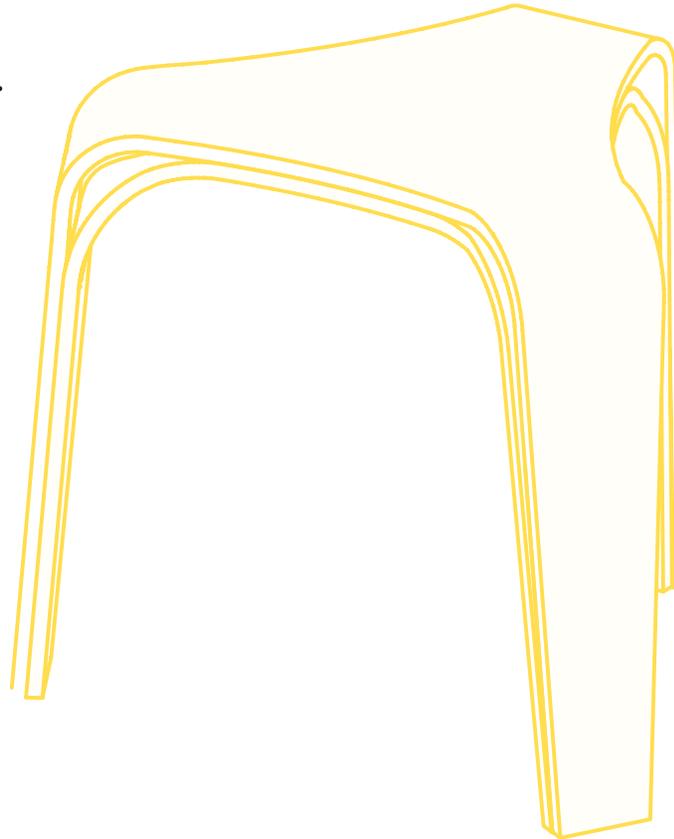


to avoid making a second mould for the cross brace and to give the piece more structural support I decided to laminate two thinner pieces.

form resolution.



range of colors from cochineal and annatto seeds



casted flat, once congealed legs are bent



alternating layers of burlap and corn/hide glue mix

color and edge treatment.

the edges or entire stool can be dyed for customization. ground cochineal is added to a mix of calcium carbonate, lime and hide glue. the color of the pigment can altered by additives to change the PH.

black beans and annatto seeds can also be a dye.

black beans



concentrated annatto



mid concentration of annatto

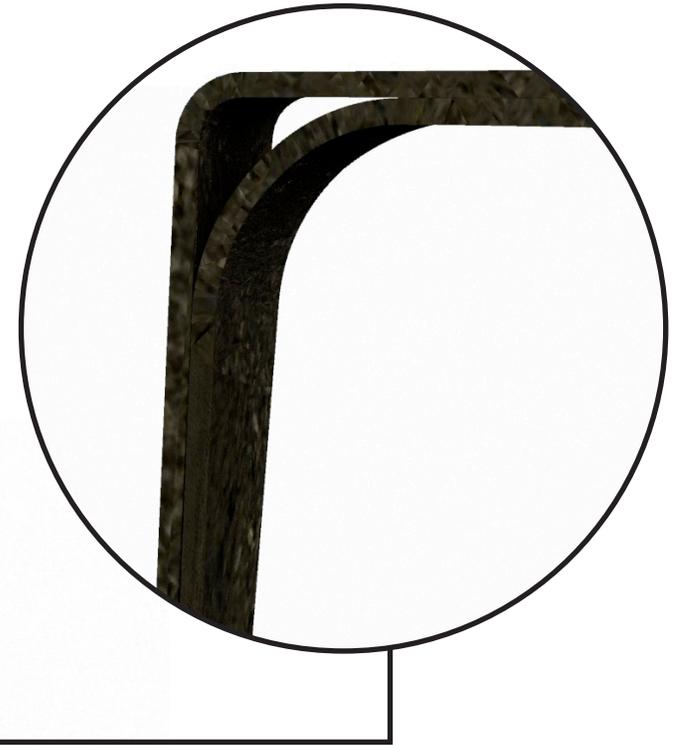
mix of cochineal an annatto



cochineal



structural support.



thinner shape of the support rail is inspired by arch bridges I was able to create thinner layers to make a lighter structure.

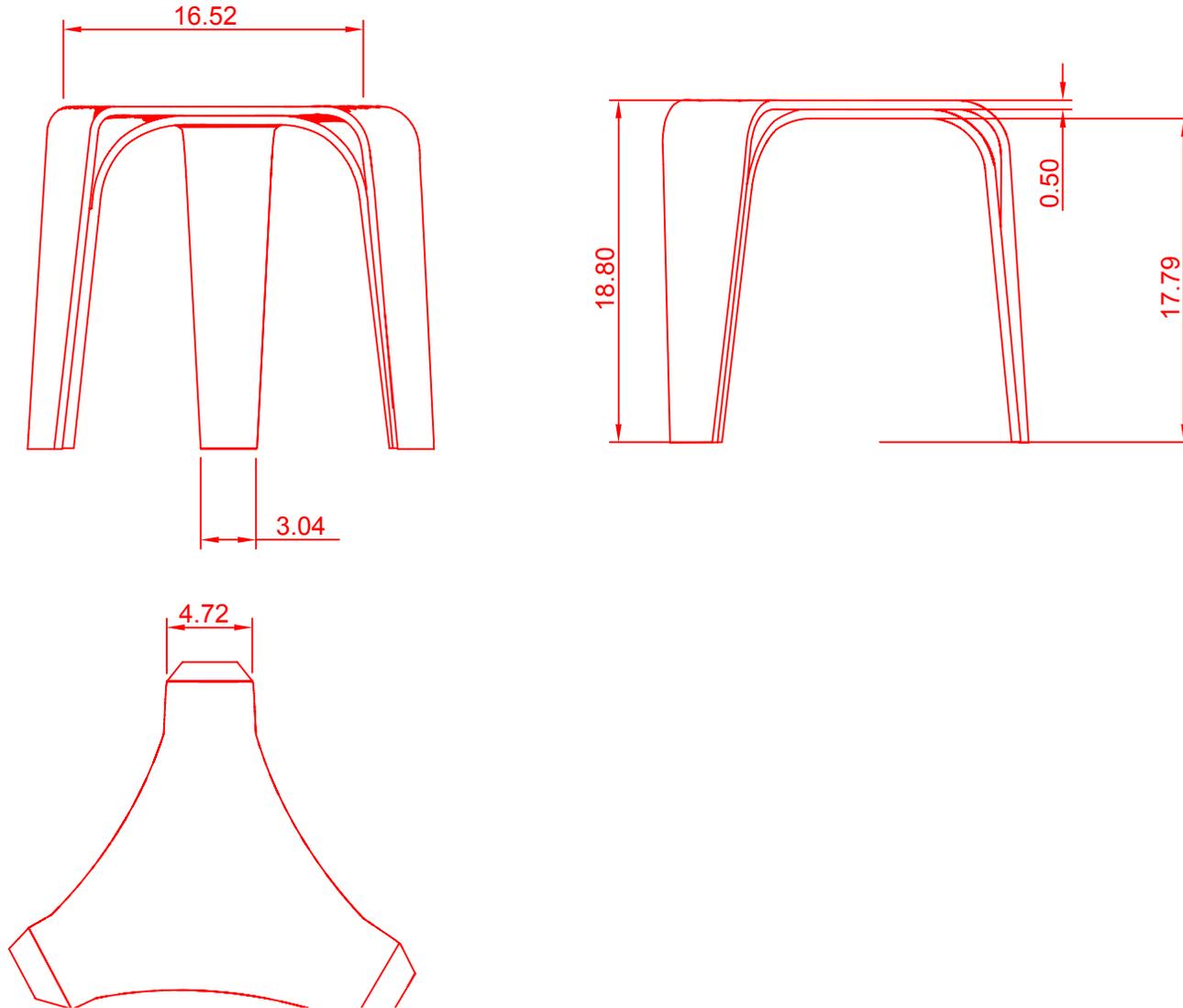
full scale sample.



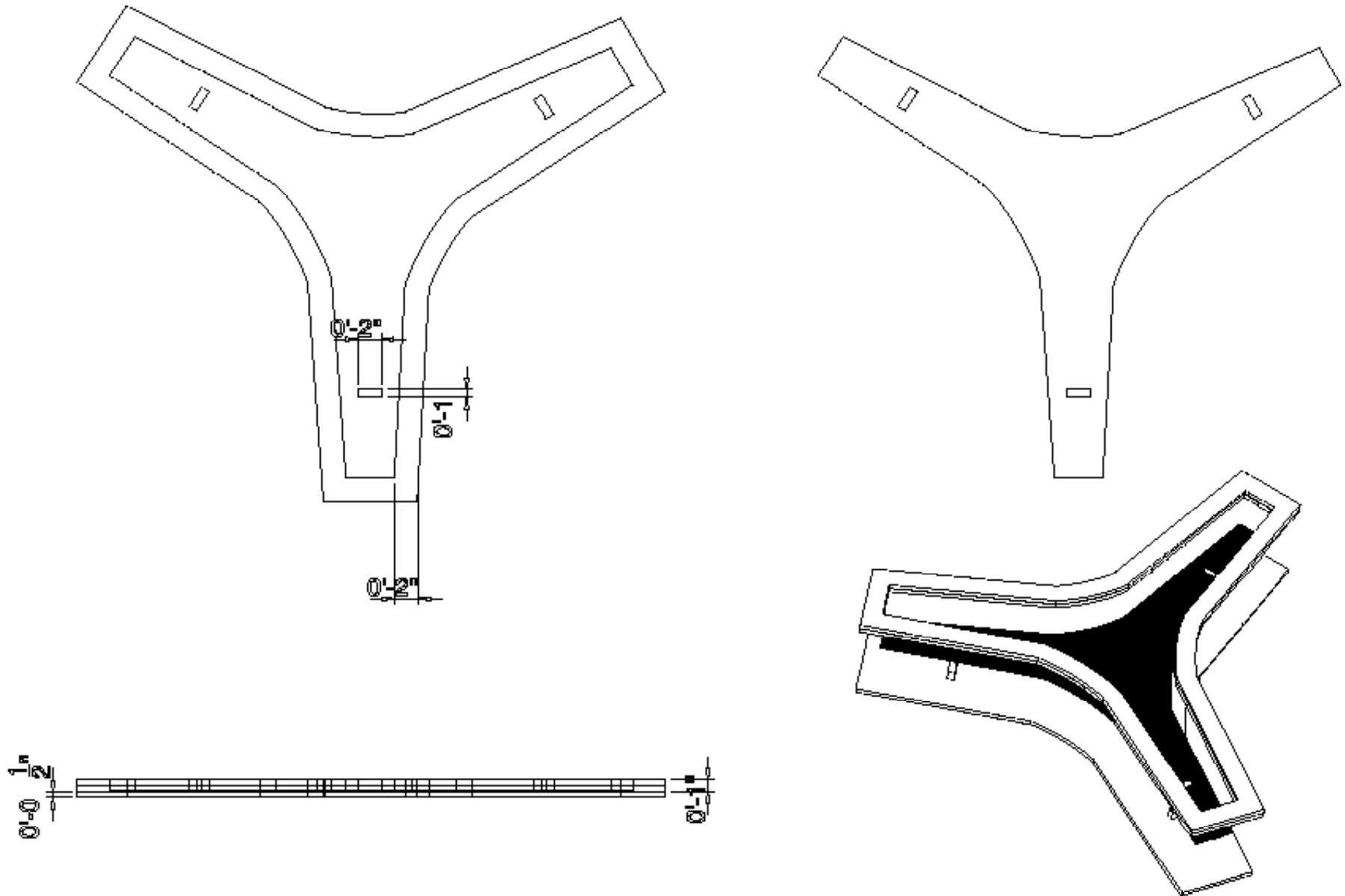
I decided to focus on a full scale sample of the leg because of constant rain that delayed the drying process. the sample turned out to be considerably lighter than the previous and was able to support 50lbs.

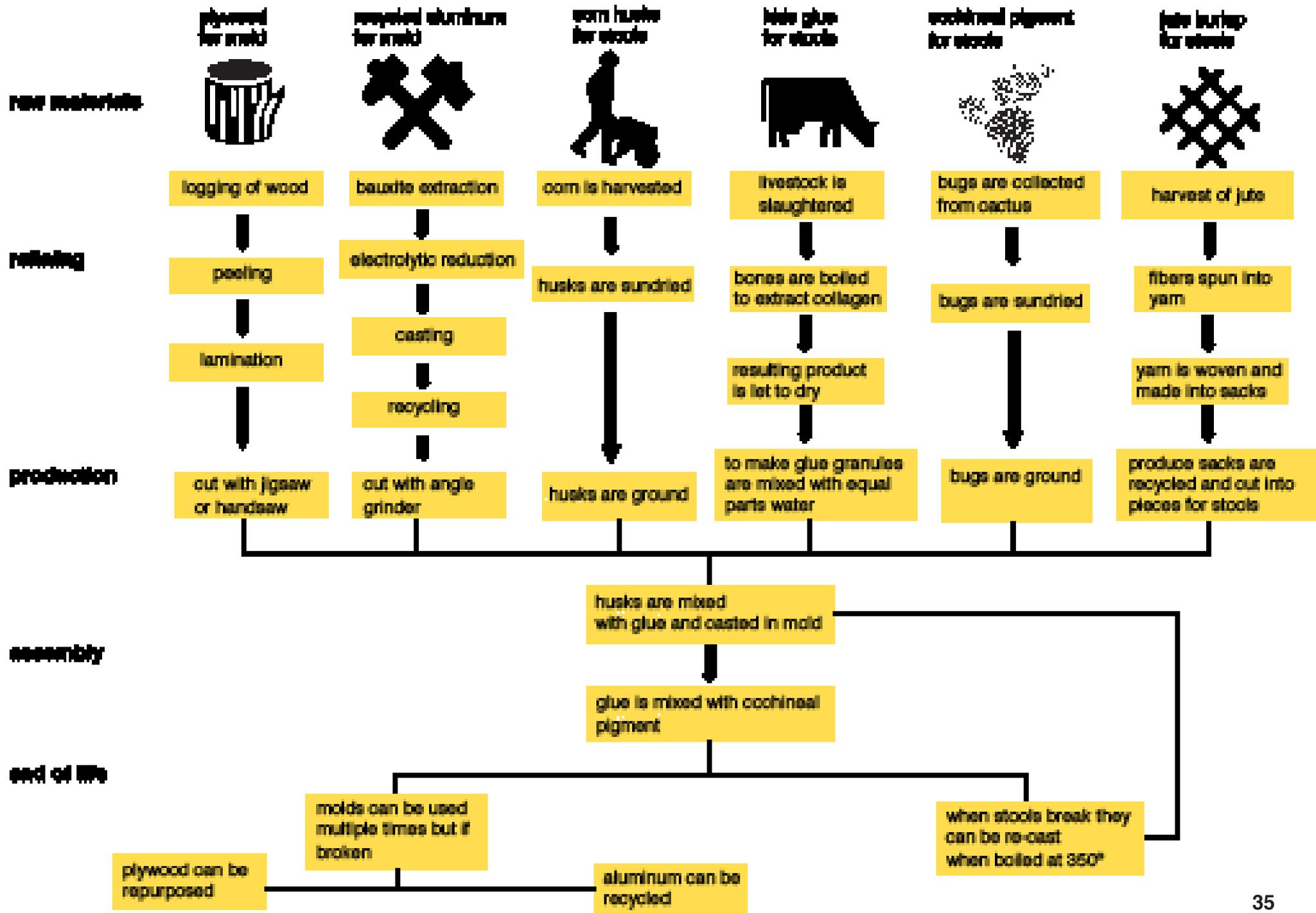


stool technical drawings.



mold technical drawings.





s
p

for
vel

broken stools
can be recast into
more stools



mill

stools sold at
competitive prices
to vendors and
makers

- non-toxic materials



acknowledgments.

I would like to thank the following people and institutions for their help with this project:

Rosa Inez Martinez
Ruben Chavez
Lucia Blanco
Georgina Rocca
Jessica Rocca
Universidad Autonoma Agraria Antonio Narro
Instituto Mexicano del Maiz
Ari Elefterin
George Pilonis
Sarah Templin
Rachel Jones
Max Garrett
Damien Vera

Ben Dimock
Eliot Park
Rowen Griffith
Siri Chilukuri
Sam Schillinger
Yandra Doering
Christine Facella
Aaron De Lanty
Erika Doering
Erika Hanson
Nicole Scanell
Tishman Environment and Design Center.

sources.

1. https://books.google.com/books?id=hSJl0sdIUHsC&pg=PA158&lpg=PA158&dq=asociacion+del+maiz+nixtamalizado&source=bl&ots=QY9ikiEVdH&sig=ACfU3U21VZYgQqXb_zc1tYXai-Xnu19MiA&hl=en&sa=X&ved=2ahUKEwiz1sWi06LnAhVNwIkKHU0oBYAQ6AEwGHoECAoQAQ#v=onepage&q=asociacion%20del%20maiz%20nixtamalizado&f=false
2. esquina, Taquero de la. “Comida Callejera: Entre La Celebración y El Desprecio.” *Economía y sociedad*. Accessed January 27, 2020. <https://economia.nexos.com.mx/?p=1716>.
3. “Diez Años Con El TLCAN: Revisión De Literatura y Análisis ...” Accessed January 26, 2020. <https://repository.cimmyt.org/handle/10883/1057>.
4. Null. “El TLCAN y Su Papel En La Obesidad En México.” *The New York Times*. The New York Times, February 2, 2018. <https://www.nytimes.com/es/2017/12/11/espanol/america-latina/tlcan-obesidad-mexico-estados-unidos-oxxo-sams-femsa.html?auth=login-google1tap&login=google1tap>.
5. <https://botanicalcolors.com/cochineal-insect-instructions/>
<http://www.cochineal.info/pdf/Appendix-III-Cochineal-Recipes-www-cochineal-info.pdf>
6. https://www.gob.mx/cms/uploads/attachment/file/525061/Tabla_de_salarios_m_nmos_vigentes_apartir_del_01_de_enero_de_2020.pdf