

Modified Walipini

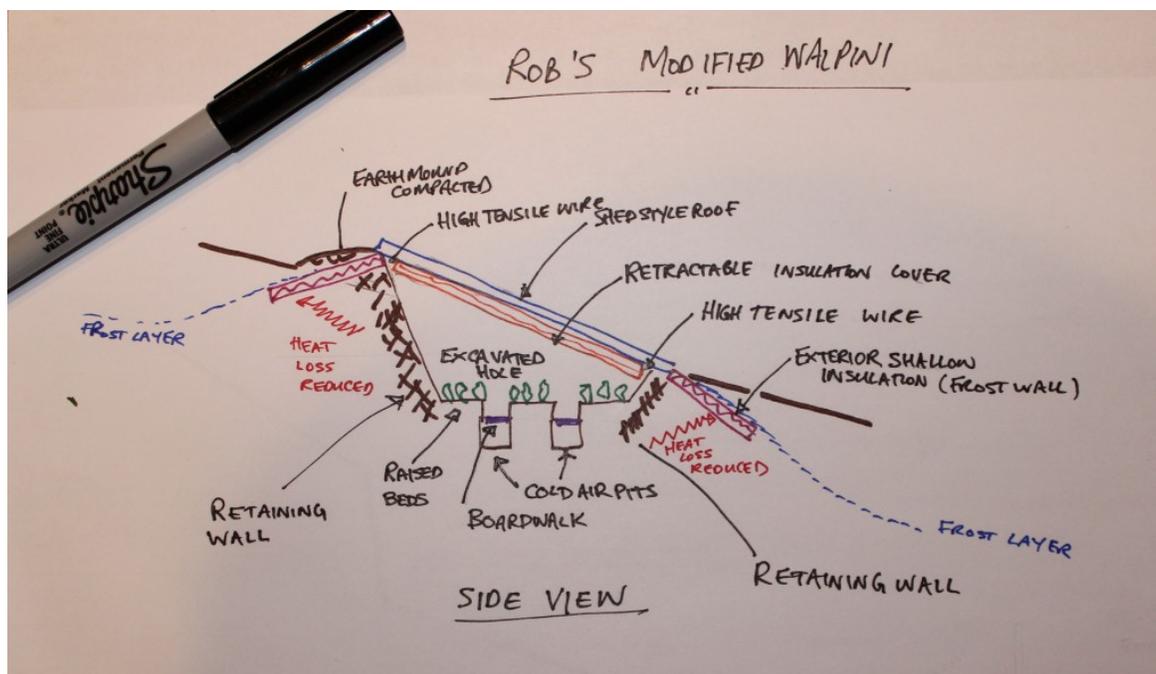
<http://vergepermaculture.ca/2013/12/robs-modified-walipini/>
December 18th, 2013 by Rob Avis

When a friend of mine told me that they wanted to build a walipini, my first reaction was, of course, "what the heck is a walipini?". The answer was simple: a walipini is an underground passive solar style greenhouse. It's an innovative and potentially inexpensive way to grow food in our cold northern climate. When I checked out the pinterest photo though, I noticed some major flaws in the design that would minimize it's potential and efficiency. So I went about writing this micro-blog, to demonstrate how I would go about optimizing this innovative growing system.

What Works With The Original Design:

1. The walipini is underground so it benefits from the low energy geothermal heat that we get at about 6 ft (or 2 meters) below ground. The earth down there is about 6 degrees C so it will help keep the space warm.
2. Because it is built underground, if the walls are buttressed properly, you can avoid the most of the cost of building materials. Really the only cost for this greenhouse is the truss system on top, the glazing material and the excavation.
3. Because it is underground you avoid the high energy loss associated with cold winds.

Suggested Design Improvements:



1. The underground nature of the walipini means that cold air will collect in the bottom of the structure. Unfortunately this is where the majority of your produce is growing. In the blog, the walipini is glazed with poly which has almost no insulative value. Therefore, as the glazing loses heat from the growing space, cold air will migrate down to the ground and create a frost pocket around your vegetables. To resolve this, I would raise my garden beds up and dig below the paths to create a cold sink. Basically wherever your pathways are, dig them deeper and then build a board walk over them. The cold air will then sink to these lowest points, instead of around the plants. (And since the space below the board walk is valuable, why not use it for something useful, like cold storage?)
2. I would build my walipini into a south facing slope and use a shed style roof instead of a gable style roof as depicted in the photo. Shed roofs are easy to build, cheap, and take advantage of

the southern aspect of the sun. These roofs are also easier to glaze (you can cover them in polycarbonate), and if the right slope is chosen the snow will shed on its own. In addition, the shed style roof has less corners. The more corners we have in a structure, the more heat loss and infiltration we have to deal with. The glazing surface is where the majority of heat loss is going to occur. Finally, with a shed style roof, it's much easier to deploy an insulative blanket at night than with a gable roof. This is important as using an insulating blanket at night can reduce your heat loss by up to 75%! For your insulation cover, you can just use an insulated construction tarp. They are cheap and have eyelets which make them easy to install on high tensile wire

3. Rescue rigid insulation from construction sites and use it to create a shallow insulation skirting all the way around the perimeter of the greenhouse. Even though it's underground, heat is still going to migrate out of the space until the pit is in equilibrium with the soil around it. This insulative barrier will prevent frost from migrating into the space.
4. I would build a rocket mass heater with a giant thermal storage bank within the space. These heaters are not perfect, but they are inexpensive and will burn whatever you give them. They store heat in their thermal mass, allowing them to burn only once every 12 - 24 hours, depending on how well your space is insulated, how cold it is outside and how big of a mass you are using.
5. On the entrance, I would borrow a design strategy from indigenous building traditions: Make the entrance go much further down into the ground than the growing surface inside the greenhouse. In essence you have to go down and then climb back up again. Cold air sinks and this depression in the ground will be your airlock. It will prevent all the warm air inside from leaving the building.
6. Keep the greenhouse longer on the east - west axis and shorter on the north - south access to maximize solar gain.
7. Use a polycarbonate panel if you can afford it. They last a lot longer and they are more efficient. If you can't afford it, use two layers of poly, one on the outside and one on the inside. Then take a bathroom fan and inflate the glazing wall for maximum insulation.
8. On the low end of the shed-style roof, install an eaves trough to harvest the rain water. Store the rainwater inside the structure for additional thermal mass, and on the north wall of the space to capture maximum solar gain.

Overall I think this design is pretty awesome. If you take these recommendations, send me some photos - I would love to see what you build!