HOW TO BUILD A SOD HOUSE

By Oliver Cameron
with Ole Wik

Many people grow up with the idea of a log cabin in the wilderness or some particular idea about pioneering. They've got a mental picture that's deficient, and that's a huge block. Even though sod houses were a part of our pioneering heritage, they're not the sort of thing that people going out into the bush are really interested in. It takes a lot to overcome those ideas.

We can't fault people for feeling that they know what they're doing and what they want. That's fine. If they're pragmatic and can see the problems, and if they have enough background to see an assortment of solutions, they're well off. But when they don't realize the consequences of their decision or how to achieve them, they're at a big handicap.

As you know, I'm talking about a house that's partly dug into the ground. Even though we sometimes call them sod houses, we need to be clear that this is not like a pioneer just stacking up blocks of sod in the Midwest.

Image: http://faculty.weber.edu/kmackay/1880_sod_house.jpg

After I got to Fairbanks, I built a little log house, but it wasn't satisfactory. It was too difficult to keep warm in cold weather. That's when I began to think seriously about underground houses.

When I was in high school, I'd written a report on a book by Stefansson—maybe *The Friendly Arctic*, I don't know. In that book, he discussed and more or less described the way sod iglus[1] were made.

When I moved to Kotzebue, I built a temporary little frame house, and then when I decided to move outside of town, I made an iglu for my family. It was about 14' square, and was very much superior to the house. I used firewood for heating.

Oliver's sod house in the Kotzebue area, ca. 1956
Image: Cameron family photos

I built it mostly out of poles, but Charlie Jones had a little sawmill not too far from where I was building, so I had him cut me a little bit of lumber, mostly for flooring.

I built it in the summertime, and then the next spring, I had work in Kotzebue. Before the snow was gone, we moved back to Kotzebue. I rented a house from George somebody, the commissioner.

While I was living there, the Noel Wien Airport hadn't been built. All they had was a little strip behind the village. I worked as a truck driver. There were plenty of Eskimo fellows who had worked at the mines and could run a dozer or a front end loader, but not many of them could drive a truck.

Building a sod house

The first thing to do is decide on the size of the dwelling. It's best to plan on having a minimum of heated space, along with plenty of outdoor storage space that doesn't need to be heated. That takes a little self-discipline.

A living space 12 or 14' wide and 16' long will give plenty of room for a small family—man, wife, and a couple of kids. That is being generous, if they use a little ingenuity. For people who are totally inexperienced, it might be a good thing to try living in a 10 x 12' tent or a little trailer house for a while to see how much room they really need.[2]

One consideration is that a larger house has less surface area per unit of volume than a small house does. Owing to this area/volume relationship, a small house of a certain floor area will not be twice as difficult to heat as a house with half that floor area.

Bear in mind that if you have an insulated area between hot and cold, heat will travel through the insulation faster when the temperature difference is greater. For example, if there is 1" of insulation and the temperature is 70 degrees inside and 68 degrees outside, the heat is not going to move very rapidly. But if the outside temperature is 68 inside and 60 below outside, it's almost as if the insulation wasn't there.

The main advantage of underground housing is that you have dirt banked up against the house, sloping at maybe 45 degrees. You need to pile the dirt all the way up to the eaves of the house. That creates a heat bank, and it's almost the same as if you were dug down quite a bit deeper into the ground.

Actually, it would be clean moss, then sod, and then dirt. By that time you will have at least a foot of thickness up at the eaves, and maybe even more. It doesn't have to be up that high, but that gives you the most efficiency. You need to balance that against the entryway—how far you want to step down into the ground.

That's covered principles. Now let's start on construction.

Pit

You begin with an excavation to provide the dirt that you need for banking and covering. First you take the sod off of the house area. Stack it up in such a way that you can find and retrieve it if it snows.

Dig your sod from an area that is large enough to extend beyond the sloping backfill. If you have a 7' wall on the house that is dug down 2' into the ground, that leaves 5' that will be covered with banked dirt above the ground. If the dirt slopes at 45 degrees, you will have to take the sod off at least 5' out. Dig right down to mineral dirt, or else moisture will follow that sod or semi-sod under the fill and get into your house.

You want your backfill to be thick enough. I don't know how to figure it out for a particular size of house, but if you're going to build a house that is 18' x 12', you'll have to dig down about 16" in order to produce enough dirt to bank up the walls. Going down deeper gives a little bit more efficiency.

Sasha Wik throws excavated soil onto discreet piles on four sides of this iglu pit, Kobuk River, 1969. Note sod from the site piled in the background. Image: Ole Wik

Posts

Four vertical posts define the shape of your iglu. If tamarack trees are available, that is the best post material available up north. Cedar is good, or any type of wood that doesn't rot easily. The lower part of each post can be charred over a fire to make it more rot resistant.

Ole Wik levels the floor after the corner posts have been set and the basic frame begins to take shape. The posts outline a rectangle 9′ by 12′. Image: Sasha Wik

Dig down at least three feet to give the posts stability, because the whole building is fastened to those posts. If they're not solid, everything will be flimsy.

When setting the posts, it's important to make a tamping pole with a small, flat end, 2" or less. Tamp down the dirt around the bases of each post very solidly, in layers. When you get close to the top of the hole, you can put some good sized rocks against the posts to increase the area that the lateral pressure is acting on. If you have no rocks, you can use blocks of wood instead—again, of something that won't rot right away.

If you live in that house long enough, your posts will eventually rot out, since the dirt will be thawed and warm all winter. The posts might squish down a little as they get rotted off, but the house won't tip over. Owing to the dirt propped against the sides, the posts won't know which way to fall. You can install sister posts next to them in order to extend life of house.

Girts (horizontal members) and ridge pole

If you are going to build a house that has a ridge pole and a sloping roof, you will have a pole on each end holding up the ends of the ridge pole, and another post in each corner of the building. The framework for the top of the walls sits on that.

On the end walls you will have a small log or heavy pole going clear across the width of the house, on one side of the post that holds the ridge up. You can just offset the post that holds up the ridge pole toward the inside of the house, and put the lateral member (called a girt) on the outside.

Where the girt sits on the corner post, flatten off or cut a little "V" notch in the corner post and that girt. Cut the end of the post top off about halfway to make a ledge that the girt can rest on.

There's no need to worry about weakening that girt by cutting those notches. Remember that half of the thickness of the log right at the end will hold up as much as the whole log will in the middle of the span. Your wall poles will also offer some support.

I usually put a post at or near the middle of the lengthwise walls, because the roof is going to be fairly heavy. There is also a fairly skookum[3] crosspiece going clear across the living area, sitting on top of those posts. Its purpose is to keep the walls from pushing in.

Any house of a practical size for a family should have that middle spreader. You might be able to get by without a center post in a 10' wall, but with a lot of sod and 3' of snow on the roof, there will be a tendency to bend.

If the walls push inward in this type of building, that will lift the ridge pole up. You need to keep this from happening. A seasoned log is not as springy as a wet log.

In this design, thick horizontal trunks support the ridge pole, doing away with vertical supports in the middle of the end walls and under the ends of the ridge pole. Slanting braces carry forces from walls with thicker dirt banking to the bases of the opposite walls. Small poles running downward from the ridge pole to the girts in the long walls do the same thing. Image: Sasha Wik

Walls

The walls and ends have to be sloping a bit because sod and dirt will settle down and shrink away from vertical walls. A slope of just 5" or 6" in a 7' wall is enough to keep the sod and dirt hugging the walls.

You can put a log on the ground on the outside of the uprights. The lower ends of the wall poles come against that log, which then keeps them from kicking in. This will also determine the slope of the walls.

Wall poles can be as much as 12" apart, center to center. Roof poles should be no more than 8" apart. I usually space my wall poles the same distance apart as the roof poles, because there has to be a smooth way for the plastic sheeting to come down over the eave as I pull it down over the wall.

I let the roof poles extend out a little ways, flattened a bit on the underside. Then I install the wall poles so that they come up underneath those flat places. I saw off the ends of the roof poles at an angle, and then smooth the end with hatchet or draw knife or whatever so that there is a rounded surface for the plastic to come over.

Door

You can just hang a bear skin for a door to start with. If you use fur for insulation, put the skin side out. Otherwise, moisture will form between plywood door and the skin, causing it to deteriorate rapidly.[4,5]

If you are using mostly local materials and you have a good rip saw, it would pay to rip out 2x4s and fit them together so that you have a door that is 2" thick at least. Make the door with a crosspiece at the top and bottom and a diagonal to brace it.

Ole, this is where you would tell the story about how you opened the top of your Dutch door to shoot the grizzly that was just outside. I don't usually make a Dutch door, but I have a big window in the door that can be opened. It has a wooden shutter than I can open from the inside so that I can see what is out there, and I can shoot through it if necessary.

If your door is set right in a sloping wall, it will want to swing shut or open, depending on how it is hung. It's better to figure out a way to make a door frame so that the door is vertical.

As for building a covered entry, it's easiest to ignore that for the time being. You need to focus on getting a livable shelter as soon as possible, so concentrate on getting the core of the house taken care of. Afterwards you can frame an entryway that butts up against the house, separate from the house frame.

Windows

When you are putting the window in place, you put up a couple of wall poles to start with, and fasten that window frame to them. Make the frame out of poles, and make it fairly wide from the inside to the outside so that it will extend out from the wall to allow for the sod and dirt that you will be stacking against it.

Place the frame in your wall so that it will be upright, or if anything, sloping out an inch at the top so that the outside will stay clean longer. It doesn't matter if the frame isn't

totally uniform, because you'll be counting on Visqueen[6] or some other wrapping to seal it.

Here's something you should think about. You have a rough opening boxed in, but in order to set a window inside of that, you need a fairly smooth surface so as to be able to chink around it. This is especially true if you want the window to be able to open.

A thermopane window would help. You can make one using Mylar, with 1" gap between layers. You can install a vertical or horizontal crosspiece between the layers to maintain that space. It's a lot easier if you have multiple layers, two or three dead air spaces, so that the window will keep clear for visibility. I usually make that up as a separate unit and fit it into the frame afterwards.

I have designed a rip saw that is much more efficient than an ordinary hand rip saw, so it's easy for me to cut material for things like that. But you can just flatten or hew lumber and true it up as best you can.

Roof

Ole and Sasha made their roof by laying closely spaced poles from the ridge pole to the girts. They left a space in the center of the back wall for the stovepipe safety, and two more spaces for skylights. Image: Sasha Wik

Vapor Barrier

Once the shell of the iglu is finished, you cover it over with plastic sheeting. You need to leave plenty of slack in the plastic on the roof so that it can bag down a little bit between the roof poles. It comes down 6 or 8" to lap over the outside of the wall covering. That way it's not nearly as likely to tear where it comes over the edge of the roof.

The plastic comes up almost to the top of the walls, then folds over in a little series of folds. With two layers, it won't tear easily. At the top of the walls, I double 6-mil Visqueen over a nailer or half pole to hold it up. I nail it right to the wall, because the roof plastic will cover it.[7]

At the bottom of the walls, I usually dig a ditch and let the Visqueen come down into it. The ends of the poles go down into the ditch. You need to put an extra strip of Visqueen into that ditch so that the poles won't be directly against the dirt.

Oliver is describing the system he used on this iglu, built on tundra near Ambler. Image: Sasha Wik

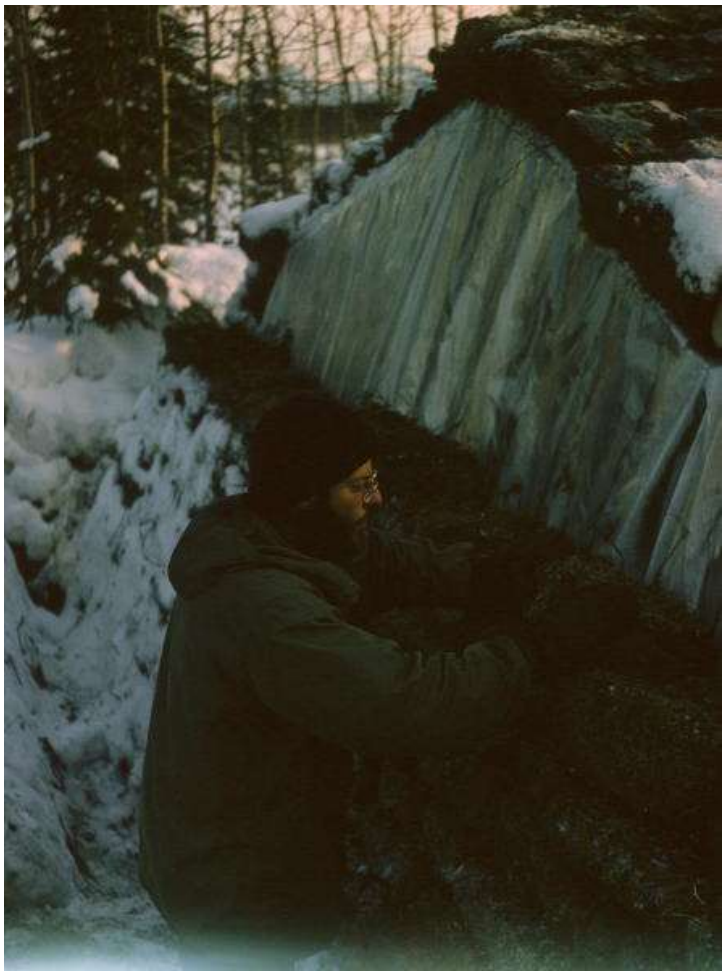
At the ends and around the doors and windows you have to cobble enough material together in whatever way seems best, remembering to make your overlaps in such a way that water will shed out.

Moss and sod

Now you have to start sodding up the walls. There are two ways of doing that. One is to bank dirt part way up, and then put the sod above that. I prefer to put sod all the way because if you just bank the dirt against the Visqueen, the walls will freeze up. Then, when you build a fire, it will take forever to get the house warm. If you have a sod wall on the outside between the dirt and the Visqueen, it will warm up much quicker.

I usually cut bricks of sod, maybe 8" wide and however long, and stack them atop one another. As I go, I put pure green moss right against the plastic, and then the sod. This prevents roots in the sod from catching the plastic.

The sod will eventually settle, so when you get to the top of the wall you put an extra course above the roof line and let the roof sod come over it. You will almost certainly have to go and chink the gap later.



Dan Denslow applying sod to the rear wall of his iglu, Ambler, 1964.
Image: Joyce Denslow

You put a layer of fairly good size pieces of the best and cleanest sod on the roof poles. For the first layer, you put the rough side up, dirt side down. If there is a little frost in the ground, you will have some dirt hanging on the bottom of the sod. That's all to the good, although I don't plan on it.

I examine every piece of sod that goes up there to make sure that there are no big roots that will puncture the roof plastic. If you have a good sod cutting tool, it helps a lot to keep the bottom smooth. If not, you can take an adze or an axe and smooth off the bottom side before putting it up on the roof.

I put a bunch of sticks or branches on top of the first layer of sod, maybe 1 to 1-1/4" in diameter—not too small, so they won't rot too soon. They tend to hold everything together and help to keep the whole layer of sod from sliding down and exposing a rather extensive area along the ridge pole. This is not essential, but it seems to help some.

The problem is that the sod shrinks in dry weather, and gaps open up. Then when the rain comes they swell up again and the gaps more or less close, but sometimes not entirely. Then you can go up there with a bucket of moss or sod material and chink the gaps. That's easier than trying to rig up a way to hoist large sods to place along the ridge pole.

When I put on the second layer of sod, I usually overlap the gaps, or at least make sure that I squish them together. Sod has a certain amount of give. If your chunks are uniform, it's better to offset the joints.

In the fall time that roof will be wet, so its insulation value will not be as high. In the not bitterly cold fall, it will take a little more to keep the house warm. However, snow is a great insulator. Once it gets deep enough that it won't melt, the house will be much warmer.

Or, to keep your roof drier, you can make a frame out of logs 6" or more in diameter after you put your Visqueen on the poles. Fill that area with moss, and then put another layer of rafter poles and plastic on top of that. That will give you a layer of good insulation, with a vapor barrier above and below. The Visqueen should not extend in such a way along the ends that sunlight can deteriorate it.

That second layer of roof poles and plastic gives moisture a way to get out of the moss during dry weather. The air can work through the ends of those poles where they lap onto the log framework that holds the moss in place. It's the same for any water that leaks in around the stovepipe or whatever, in spite of your best efforts. That's important, because otherwise things could start to go bad.

Dry moss can be a fire hazard, but you can use the same method for the stove safety as I described for a log house. Then you'll have a dirt roof above the moss that is sealed against the safety.

Backfill

You cover the walls with dirt for two reasons—it seals the insulation to some extent, and it keeps chimney sparks from starting fires when the sod is dry.

Ole and Sasha backfilled the walls before building the roof in order to prevent the piles of dirt from being covered by snow. Image: Sasha Wik

That about does it. Let me say that these are principles, not specifics. I'm trying to describe what is involved so that folks can adapt it to whatever circumstance they have. It's like a lot of other things—if you understand the principle that you want to use, you can usually figure out a way to do it.

Ole and Sasha's completed iglu—a simple, small, snug home.
Image: Sasha Wik.

Distant view of the homesite. Photo: Sasha Wik

Years later I met a young couple in Fairbanks. They were very interested in building a sod iglu, so I worked with them for two or three days, to where they had the frame up and were starting to put poles on it. After that they didn't need my help.[7]

I'm quite impressed with the ability of most people to adapt to their situations in one way or another. I know of more people who have made a success of building and staying in the North than those who failed and had to give up.

EXTRA SECTION[8]: MORE IGLU PHOTOS

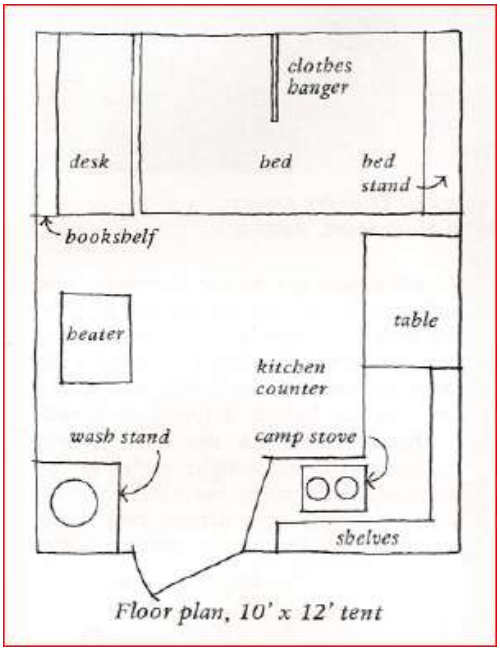
By Ole Wik

Ole Wik's first iglu, 1965. It measured 9' x 11' at the top frame. The flat roof was insulated with two layers of moss, separated by a sheet of Visqueen (as described above). Windows consisted of two sheets of Mylar inside and outside of a frame made of sticks. Entry was via a tunnel (opening shown in lower left corner. Image: Ole Wik

Ole inside the iglu described in the text, ca. 1970. The windows consist of one sheet of transparent vinyl. Note separate removable shutters made of Visqueen wrapped around both sides of simple pole frames. Image: Sasha Wik

1) Vilhjalmur Stefansson lived and traveled with the Inuit of the Central Arctic Coast of North America from 1906 through 1912. He wrote that in the Inuit language, an *iglu* is a "more or less permanent shelter for man or beast". ("The Eskimo Word 'Iglu'", Science, New Series, Vol. 73, No. 1889 (Mar. 13, 1931), pp. 285-286. (https://www.facebook.com/permalink.php?story_fbid=112714995426660&id=54314802274)

2) Suggested floor plan for a 10' x 12' wall tent. Source: Wik, Ole. "Tent Top." *Shelter II*. Ed. Lloyd Kahn and Bob Easton. Bolinas, CA: Shelter Publications, 1978, 166-169.



3) Sturdy, substantial, strong. "Skookum is a Chinook Jargon word that has come into general use in the Pacific Northwest." (http://en.wikipedia.org/wiki/Skookum)

4) This essay stems from a series of telephone conversations that Ole Wik had with Oliver between December 2007 and February 2008. Highlighted text indicates remarks made by Ole.

5) Sasha and I used a caribou hide on a frame of light poles, with the fur on the outside. The door was very light, and without plywood, condensation was not a problem. The door slanted with the walls, and so held itself shut.

Actually, it was a Dutch door—two separate doors, one above the other. Thus we could open the smaller upper one to varying degrees, say for ventilation, while the lower portion remained closed. One time I we would have been totally snowed in if I hadn't been able to get my arm out the upper door and clear enough snow to crawl out.

6) "Visqueen" is a brand of polyethylene plastic sheeting, and has become a generic description for any plastic sheeting. It is commonly between 4 and 10 mils thick and is available in clear, opaque, and black. (http://en.wikipedia.org/wiki/Visqueen)

7) Plastic sheeting is the key to this kind of structure. It keeps a bubble of warm air inside, while keeping water and bits of dirt and moss out. Sasha and I also used 6-mil Visqueen. We stapled it lightly at the tops of the walls in anticipation that settlement of

the dirt would pull the plastic free of the staples over time. To compensate for that, we let the roof plastic overlap the wall plastic by quite a bit, thus maintaining coverage on the top of the walls even after the wall plastic had settled somewhat.

8) For more on Oliver's techniques for building sod houses, and more photos, please see Carol Schlentner's reminiscences under the Tributes section of this website.

Carol Schlentner and daughters Tonya and Paula by their sod house.
Image: Curt Madison

9) When one of the air transport companies in Kotzebue had more mail or freight than could be accommodated on regularly scheduled flights to Ambler or one of the other villages in the region, they would often lay on a non-scheduled flight that they called an "extra section". Many times they would have room for passengers as well.

In the present context, I'm using the term for topics that Oliver and I had talked about over the years but which we didn't discuss during our series of interviews in 2007-2008.

Additional resources:

- For an article on building Ole and Sasha Wik's sod house shown in the images above, see Wik, Ole. "Sod Iglu." *Shelter*. Ed. Lloyd Kahn. Bolinas, CA: Shelter Publications, 1973, 151. It contains many construction details.
- For an article on building a semi-subterranean earth-banked house using commercial lumber, see Wik, Ole. "Rigid Frame." *Shelter II*. Ed. Lloyd Kahn and Bob Easton. Bolinas, CA: Shelter Publications, 1978. 144-145.