

**Season Extension Off-Grid Greenhouse
AAIG Grant Recipient
Project Report 2012
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I am delighted to say that this project has been innovative in more ways than one. Simply searching the world of Google, local libraries, and sharing stories with experienced growers in AK was not enough to paint the picture of how to successfully build this greenhouse. Originally inspired by the effort and diligent experimentation of season extension entrepreneurs, Anna Eddy of Solviva, and Eliot Coleman of Four Season Farm, I was encouraged to utilize their lessons learned while drawing upon my own experience to create a unique greenhouse.

The lack of quality, year round, local food in Alaska fed my desire to grow food earlier and later in the season without electricity and lights. However, challenged by sun angles ranging from low to none, with extreme cold temperatures, presented a feat I knew would require some gambling and combining of ideas. I have dreamt of undertaking a project such as this for the past 10 years. When I received this grant, I knew it was time to make the dream a reality.

Building this greenhouse has been an unbelievable experience in learning, problem solving, persistence, and rewards. When I initially wrote the grant proposal I intended to design and build an off-grid permanent greenhouse out of recycled milk carton bales, locally milled spruce, wood heat, radiant floor heat under the beds, and passive solar techniques to maximize and utilize the heat and energy from the sun to grow plants earlier and later in the season. Although I adhered to most of my initial intentions, others changed due to external factors.

Like any great dreamer, plans change throughout their emergence. I never could have imagined or dreamed this greenhouse would turn out so well. Along the way my patience and skills were tested time and time again. Throughout the building process I tested my skills as an architect, engineer, designer, chainsaw miller, and dreamer. Obviously no one could perform all these skills successfully. I had to open the shades to reality, and in doing so make a few sacrifices.

The first sacrifice had to do with building materials. I wanted to build the north wall out of recycled milk carton bales. Although strong and durable, the bales were an engineer's worst nightmare. Although we could not afford a real engineer, when given the opportunity to draw a few sketches on napkins and ask a few questions, responses included skepticism and just not really knowing. Most builders in Alaska we talked to had conventional experience with little to no understanding of building earthship style into a hillside and the inherent frost heave potential. It was clear we would be gambling to some degree, which made the project a challenge from the start. After weighing the benefits and drawbacks of various materials we decided that concrete block would be the best material in terms of strength, longevity, and heat retention.

Another sacrifice had to do with milling spruce for the project. The past eight years we have chain-saw milled nearly every piece of lumber for our numerous building projects. My goal has been to buy fewer materials with every additional project. As it

turned out, the grant guidelines would not compensate me for the cost of milling my own wood. I still milled all the posts and beams, knee braces, and minimal dimensional lumber. Although buying wood deflated my morals and chipped away at my conscience, it ended up saving us time by speeding up the building process.

As I look outside at the several feet of snow lying over the garden beds I wonder when we will be able to plant out this year. Fortunately, this greenhouse has given us a significant head start on an early greens crop, tomatoes, peppers, and herbs. In addition, we pulled roots, such as turnips, kohlrabi, and beets, out of the root cellar and “forced” them to grow by planting each one in a 5gallon bucket with drain holes in the bottom. By mid-April we were eating mixed asian greens, mesclun, lettuce, parsley, basil, turnip greens, beet greens, and kohlrabi greens. Crop productivity has already increased twofold with the addition of the new greenhouse and will continue to increase our yields in future years.

The greenhouse has capacity to grow more than 10,000 starts in soil blocks in the upper loft, window benches, and in the germination station on top of 50gallon water barrels plumbed with copper pipe to keep the water warm. The warm water will speed up and increase the plant’s germination rate. In addition, I have designed 9 hanging grow tubes, each 10ft long with the capacity of growing 50 plants in each tube. These grow tubes have “cut and come again” greens and herbs. Making more of these tubes will help make the best use of the vertical space in the future. Currently in process of being built are the permanent raised beds. These beds will provide additional planting space of 30’ by 100’. It is already clear that the additional space in this greenhouse in conjunction with the wood heat will provide a space to grow more food, earlier and later in the season, and for years to come.

Next season we plan on firing up the wood stove in the greenhouse in early February and maintaining it thorough November. In Chickaloon, the sun goes behind King Mountain in November and returns in February. Being able to grow food for 9-10 months of the year will give us a significant advantage in terms of what we can produce. We will be able to grow hot crops like tomatoes, peppers, cucumbers, and beans longer in the fall. Then we will transition to growing super cold hardy crops like scallions, mache, spinach, claytonia, winter carrots, etc. in the low to no sun months. If these crops are mature by the time the sun disappears, they will go dormant under row cover in the greenhouse, and continue to grow when the sun reappears in February. This will be a significant head start to the season. I am looking forward to experimenting with these techniques that have been used successfully by others growers around the world.

This winter we fired up the new greenhouse the middle of February. The greenhouse still had gaps and cracks to be filled, needed insulation above windows, water barrels to be plumbed and filled with water, and set up the copper coil around the wood stove with adjoining pex pipe under the beds. Even with all this unfinished work, the greenhouse still maintained 40 degrees downstairs and 50deg. upstairs through the night after loading the stove before bed. All this when the temps outside were between 10-20deg F. During March I was still loading the wood stove in the am and pm but the temps were staying between 50-60degF. In April, I loaded the stove in the evening only, and maintained temperatures in the 60-70degF range. When compared to our smaller 8x10 double wall plastic wood-fired seed starting house, it was clear that the mass wall on the north side of the new greenhouse played a large role in holding heat and

maintaining the temperature. We did not see the significant swing in temperature that is commonplace in our smaller seed house.

As the season progresses, four fans on the east and west walls will assist in ventilating the greenhouse to avoid overheating. Two high fans will exhaust hot air while the low fans draw in cooler air. The fans run on DC current directly from one 185watt solar panel. The clerestory wall on the upper south wall has 8 opening windows each with an automatic vent arm attached. These arms begin to open at 70degF which is adjustable to open sooner or later and works via an internal thermostatic chamber in the piston rod. These vent arms are lifesavers for not frying your plants and have been tried and true in our hoop houses and other structures.

Questions that remain to be answered pertain to adequate ventilation issues during the heat of the summer, potential pest problems in permanent beds, and the longevity of the wood structure due to moisture. No matter how well a greenhouse is built, certain problems are inherent in building any permanent greenhouse. Although well thought out ahead of time, time will give the real answers.

Proper ventilation should theoretically mitigate mold, pest, and wood rots issues. Fans and opening windows will assist in ventilation. In addition, the south wall windows were built at a 70deg angle to maximize sun during the spring and fall, but limit overheating during the summer months when the sun is overhead. Lastly, rotating crops to the best of our ability, adding significant compost, incorporating ladybugs and beneficial herbs should help to ward off pest problems. Issues that arise will be dealt with using our knowledge and history from past experiences and talking to other farmers. I am looking forward to making this structure more energy efficient by incorporating the radiant bed heat and water barrels, creating a more efficient use of space for maximum plant growth, and enjoying sitting and watching the plants grow.

This greenhouse has already become a multi-faceted community space to get-together in Chickaloon. We have had gatherings to make soil blocks, congregated as a community to talk about future projects, held potlucks, and most importantly created a space and time to sit in this structure and think about how we want to create our future rather than depend on someone else to do it. This greenhouse holds so much potential and promise for others to replicate, improve upon, and grow even more food. The backyard enthusiast, less than 1 acre homeowner, small farmer, modern day homesteader, and community councils, can replicate this structure. The more people who are willing to take on a project of this sort, the stronger and more resilient our communities become. This greenhouse is a true representation of our dedication to hard labor, persistence, love of shoveling (ha ha), and passion for visualizing and creating a multi-faceted space that will continue to push our limits with season extension for years to come. Thank you for the opportunity to create such a space.





