1. PROJECT AND CONTACT INFORMATION

Converting Conifer Row-Plantings to Black Locust Production

FNE02-413
Final Report

Dave Gell, Black Locust Initiative, Inc.
PO Box 707, Trumansburg, New York 14886
www.blacklocust.org
(607) 387-6750

Conifers have a low timber value, and black locust (*Rubinia psuedoacacia*) is experiencing increasing demand as a fast growing and non-toxic substitute for pressure-treated wood. The farmer will selectively replace conifers with black locust and 10 percent other species, quantify the differences in sales and yield, and determine the economics of soil amendments done at the time of planting. Outreach will be through curricula, presentations, and forestry and community events.

2. PROJECT GOALS

The Soil Conservation Service once promoted conifer plantations as a method of improving areas of poor agricultural practices and controlling soil erosion. In Upstate New York, while the soil conservation objectives may have been achieved, the timber value of the plantations is often low, because the row-plantations became overcrowded, and because choice of species and seed sources were not always well adapted to the local climate. Because of their low economic return, local conifer plantations are not usually managed. The original investment of planting conifers, however, can be considered an investment as it has provided the forest conditions for growing high-value hardwood species through selective thinning and planting. Mixed species plantations emulate natural ecosystems, resulting in diverse, healthy forests. Black locust provides a good option for inter-planting into low-value conifer plantations, because it is fast growing and durable, is currently in demand as a naturally rot-resistant, non-toxic alternative to pressure treated lumber, is saleable with minimal processing as posts and green lumber, and is well suited to the regional environment.

Our project objectives were to:

- Benefit farmers by developing a management plan for increasing the profitability of local conifer plantations and producing durable lumber for organic farm needs
- Produce seedlings of superior black locust varieties ('shipmast' locust) using bottom-heated cold frames
- Plant black locust and other important species into existing conifer plantations, after first thinning to establish clearings of the appropriate size to promote locust productivity
- Improve site index through monitoring and management of forest soil nutrition, and by

leaving the biomass on-site

- Evaluate the costs and benefits of inter-planting hardwoods and adding calcium to the forest soil
- Extend the concepts and the methods by conducting community forestry workshops

Production of "pressure-treated", or more correctly, "pesticide-treated" lumber is currently under national scrutiny because of the toxicity of the associated metals (Cr, As). Some forms of chemical treatment are now prohibited. Black locust is a tree species that is naturally rot resistant, fixes nitrogen, and grows quickly in the Central New York area. The black locust acts like a green manure for strengthening the diverse potential of the living forest. Beginning in the 1930's, the Soil Conservation Service established many row-plantings of scotch and red pine, larch, Norway spruce, and Douglas fir in abandoned fields across the United States. We applaud them for stabilizing and structuring these soils. With the exception of larch, however, the plantations have not produced valuable timber. Now the highest intrinsic value of these plantings is to provide optimum conditions for growing more valuable species; noting that locust is a traditional farm commodity. In a setting where citizens can proactively provide for their future material needs; fast-growing locust is a tree that can bridge the generations. Our initiative takes a linear approach to developing progressive forestry in the vernacular, growing locust and other species for farm needs and to niche-market locally. With good management and time, existing conifer row-plantings will become healthy, diverse forests with uneven-aged stands of high value trees. Such plantations becoming forests would have multiple benefits for farm, community, consumers, ecology, and wildlife. Progressive forestry is an industry that can expand locally while improving our environment and resource base.

3. FARM PROFILE

Black Locust Initiative (BLI) is based on eight wooded acres near Ithaca, New York. With a soil type of sandy loam, 10 percent grade, and a slight north facing slope (northern aspect), the forest trees grow well. The pit and mound terrain indicates that it has not been plowed for a very long time. One large over-mature maple was felled and made into beautiful furniture. The stump indicated that it was approximately 160 years old. Because this soil is well structured and fertile, even shade-intolerant species can persist in the understory and grow straight up (geotropic) rather than bending toward the light (phototropic). This forest condition is ideal to investigate the premise: "Phenotype = Genotype X Environmental Interaction". Growth form results from both genetics and the site index (soil, hydrology, microclimate, canopy) . For years BLI has collected root cuttings from superior black locust trees throughout the region and recorded their site conditions. A "stand map" indicates diameter, height, spacing and species diversity of the parent provenance. Soil tests focus on drainage, pH, calcium/magnesium content, and organic matter. Exemplary forestry practices are conducted at the eight-acre BLI site. Horses are used in the woods rather than tractors. On-site milling using a Woodmiser sawmill retains nutrients in the forest as sawdust, bark and scraps decompose close to where they grew. Organic, rot-resistant green lumber is sold to local niche markets. The farmstead, located in the center of the forest, provides the facilities for seedling propagation, nursery production, lumber milling, and on-site workshops. Meticulous record keeping is used to identify and propagate the best locust varieties, and growing the best locust trees in proximity may result in seeds with

hybrid vigor (combining progeny tests with seedling production). Observably, the black locust seedlings enjoy being grown in small clearings in our healthy forest where they receive light from above, and where the diameter of the clearing is just smaller than the height of the forest canopy.

In our original grant application, we identified a collaborating farm site with a low-value conifer plantation suitable for our management objectives. Unfortunately, the collaborating land owners made a series of poor decisions that made it impossible for us to work with them. We therefore identified a second conifer plantation for implementation of our objectives. This second site was a scotch and red pine row-planting behind the local Interlaken Elementary School, owned by the South Seneca School District. The site has a low timber value, but a high value in outreach capability because of its proximity to the school. Each of the progressive foresty concepts involved with inter-planting hardwoods was discussed with the school board and administration in this rural agriculture-based community. Students were involved in hands-on forestry workshops. The close proximity to the school meant they could simply walk across the athletic field to get to the workshops that were held in their woodlot. Most of this grant's activities could be related to New York State Department of Education (NYSED) standards, therefore the school woodlot was thought to be a good candidate site. The NYSED Science Standard #7 requires students to understand that human policy has an affect on our environment. Doing this project within sight of the classroom providing us with several life-size example to aid teachers in explaining concepts. The term "community" can be seen to mean bugs, birds, soil, plants, and mammals, in addition to the students. Adult participants can now extend the inter-planting methods to plantations near where they live.

4. PARTICIPANTS

- Dave Gell and various employees of the Black Locust Initiative. Nursery management, seedling production, timber felling, tree planting, workshop management, and project reporting and development.

- Allan Buddle, Fertrell, Inc., organic soil fertility specialist. Presented to Interlaken fourth graders the importance of soil and organic matter to plant growth. Students were fully engaged and interested, as they learned hands-on. Surprisingly, some students in this rural area already knew that calcium was the most important mineral controlling nutrient availability in their locale. Allan described soil compaction, soil profile, the forest's soil organic layer, and soil nutrition. He collected soil samples that were processed at the Fertrell laboratory, and subsequently made soil amendment recommendations.

- Carl Leopold, Professor Emeritus, Cornell University. Presented the ethical concepts of land management to the students, tying it to small-scale production of timber to providing for personal material needs. By showing slides of his Reforestation Project in Costa Rica, he engendered interest in environmental careers and the importance of learning academic skills.

- Kim Boland, a fourth grade teacher, had participated with BLI years ago on a trip to nearby Cornell University locust/walnut test plot. Later, his fifth graders built a locust bridge in

Ithaca. With this foundation, Kim explained to the South Seneca School Board that collaborating with the project was a logical next step toward planting trees which will grow as the students grow.

- During the grant period Bob Waller, a biology teacher, became principal of South Seneca High School. Having attended BLI programs and with the belief that locust was better than chemically treated wood, he supported the use of the planted pine site in his district behind the Interlaken Elementary School based on science and improved logistics.

- Thanks to B.O.C.E.S. (a NYSED program) for enrichment funding. Elementary school principal Margaret Koture facilitated the collaboration with South Seneca School District, with the assistance of business teacher Stuart Mattey and Paul Brown of the building and grounds department.

- Doug Haight, New York State Department of Environmental Conservation. Assisted with timber stand improvement and tree felling, provided safety equipment.

- Martha Twarkins, Fingerlakes National Forest manager, as well as a mother of children within the school answered many questions, bridging academia and administration.

- Liz McCheyne 5th grade class used the school survey map to locate the forest boundary and generated the environmental and social policies for land-usage signs.

5. PROJECT ACTIVITIES

We stuck to the original project goals. Although we changed the location of out stand management activities, as described above, we succeeded in attaining our objectives of producing healthy seedlings, thinning and inter-planting a low-value conifer plantation, evaluating and refining out techniques, and extending the methods and goals to the local community.

A nursery was maintained at the Black Locust Institute headquarters location. We produced several hundred healthy black locust seedlings in 2003 and 2004, along with some seedlings of American chestnut, white oak, and catalpa. Meticulous record keeping continues to assist our objectives in developing superior black locust seedlings using seeds and root cuttings collected from superior individuals found within 30-miles of our location. Developing superior locust varieties is important, because straight-growing varieties have a much higher timber value. We had originally planned to experiment with using composting of manure to provide bottom heat for nursery cold frames (bottom heat is thought to promote a better ratio of root to shoot growth in seedlings), but we instead provided bottom heat by building the cold-frames into the wall of a building, such that the top of the nursery beds was exposed to the outdoors, while the underside was in a room heated by a wood stove. This appeared to work well, and numerous high-quality seedlings were produced.
Nursery practices: Locust seeds with a waterproof seed coat need to be scarified to germinate: Immerse seeds in boiling water for 30 seconds; or individually nick with a toenail clipper the end away from the seed to pod attachment, so a tiny amount of white shows through the brown seed coat. Soak seeds overnight then plant ½ inch deep if in pots indoors. If planting outside make them a bit

deeper. Schedule this as you would tomato plants in your area – not too early, lack of sun makes them spindly, but hot weather reduces germination. Standard black plastic tree pots 2 ½ inches by 10 inches are good for one season with seeds but are a little hard to keep adequately watered without drying. We obtained four-gallon square white plastic frozen food containers from a recycling center and drilled six ¼ inch holes in the bottoms. These work well for the second season. Potting soil was collected by grading an area where a sawmill had previously operated; a mixture of rotted wood and subsoil. Masonry sand was added to obtain a friable texture, and the pots were inoculated with nitrogen fixing bacteria by adding a small amount of parent soil from a nearby locust woods. When transplanting, 1/8 inch nodules harboring nitrogen fixing bacteria should be visible on the smaller roots. Any encircling roots growing around the inside of the pot should be teased out or cut. The planting hole should be square rather than circular. This promotes root growth into the native soil. Occasional pruning of the lateral roots will enhance a dominant vertical leader. Transplant on a cool damp day in spring or fall.

During every transplanting operation a new white plastic marker was added to each seedling, with one side marked to the previous in fresh permanent ink, and the other side showing the workers initials, date and number corresponding to the day's data sheet. This data was entered into the permanent record that included observations of seedling height, form, and success. In this way, an important seedling would have several tags, aiding tracking when tag breakage or fading occurred. Our next step will be to purchase numbered plastic tree stem rings, each number unique and not re-used. For protection from deer-browsing in the farm nursery, forest saplings were cut off at four-feet and deer netting was stretched around these to form a perimeter within a small clearing. Deer will not jump into a small enclosure, but rabbits did made their way in during early spring. This caused us to repair and reinforce the bottom two feet. Bright survey tape was woven into the mesh fence to keep deer and humans from walking into it.

Planting: Plant forest trees in a month with an "R" in it (Sept. To April) when dormant.
Some of the seedlings were planted in clearings at the BLI home forest site, where we are evaluating seedling health in relationship to gap size and growing conditions. Others were planted at our main site behind the local Interlaken Elementary School. Students pro-actively established resources for their own future material needs:

- Students visited a local locust/walnut planting, related "planting their next playground"with the tree-planting objectives, and studied forest ecosystems in class. Just before the fourth grade investigated their woodlot, BLI staff identified, photographed and put photos with leaves into sheet protectors for a simple "Interlaken Tree & Plant ID" book, to help the teachers. (The Poison Ivy picture was emphasized

- Conducted a forest evaluation workshop, Carl and Alan presented, at which time we established the foundation of a 'continuous forest inventory' with which to monitor future productivity at the school woodlot site. Forest evaluation is the first step in responsible decision making, and should include soil nutrient testing, plant identification and calculation of diversity indices, stand mapping, and evaluation of management objectives. During the workshop students placed a 1 m x 1 m quadrat frame made of small wood strips on the forest

floor. They counted the number of individuals of each species in the square and made a bar graph which was color coded for each species, and then calculated a diversity index. This was essentially an application of their New York State arithmetic objectives.

- Sent soil samples to Allan Buddle of Fertrell Inc., who recommended applying 80 pounds per 1,000 square feet of calcitic limestone (high calcium, low magnesium) in view of the site pH and calcium to magnesium ratio.
- Safely felled 50-year-old scotch & red pines to establish clearings of the appropriate size for hardwood regeneration (diameter of clearing just less than height of forest canopy). This was wisely done during the Thanksgiving break without the students, because selective felling is a tricky and dangerous business, best left to professionals. As a note of caution, if bystanders are allowed to observe the cutting of mature trees, they must be located in a defined area and separated from the timber work by a physical barrier such as a fence. We avoided the danger by thinning the conifer stand without the presence of bystanders.
- Conducted a soil amendment workshop during which fourth-grade students were given four 10' firing strips (light square-cut boards) that they laid out to make a square on the forest floor within the clearings. They then used arithmetic to determine the area of their square, calculated the appropriate amount of bagged limestone, and sprinkled it over the area. Other students set up adjacent squares and rectangles to cover the whole clearing. This activity established the importance of soil as the basis for productivity, developed math skills, and improved potential forest site productivity for the black locust seedlings.
- Planted 25 black locust, 15 white oak, 25 black walnuts, and several hundred seeds of tulip poplar in five clearings. Students dug square holes for tree planting so that new roots would not become encircled but would rather grow out of the corners, into native soil. They planted the locust and oak seedlings a little higher than ground level to maintain adequate drainage and to allow for soil settling. Walnut was direct seeded with black bird netting staked over the area where the seed was planted. We hope squirrels miss some. Tulip seed from a local superior tree was broadcast randomly to try economical direct seeding. Evaluation revealed tulip was not present in the forest. However it will be good for a short-rotation woodshop class material.
- Made bird nesting boxes to enhance wildlife habitat, concentrating on downy, hairy and pileated woodpeckers to control boring insects. At the first evaluation workshop, a picture was taken of an Interlaken sawfly adult that looked like the bark of the tree it landed on. Later this excellent photo was used by Liz McCheyne's 5th grade class to exhibit the lifecycle of tree damaging insects. The close proximity to their woods was helpful in illustrating the relationship birds have to insect control while installing nesting boxes (using aluminum nails for safe milling later, using wide bottom orchard ladders with cargo straps attached to the tree to hoist the nesting boxes into place, and wearing bright colored clothing).
- Are monitoring seedling performance and forest stand productivity on an ongoing basis, to establish optimum rotation rate of harvest.
- Have connected the education system to the ecosystem.

6. RESULTS

Healthy locust seedlings have become well-established in the new clearings, and we look forward

to monitoring their growth. Results in agroforestry typically take longer than other crops, so it is imperative to get started. The best time to plant a tree is twenty years ago! The second best time is now.

Many important NYS education standards were applied. 4th graders made parallel lines on the clearing floor with firring strips, calculated areas of squares and rectangles, and weighed out calcite pellets (32% Ca, 4% Mg) to equal 80 lbs/1000 sq. ft. 5th graders examined the survey map, color-pencilled in the field and forest and located on the map where we were standing. Picking a nearby landmark, they scaled the distance and direction to a survey pipe, and found it. Successive workshops increased their measuring skills. Communication class wrote a letter to the survey firm for clarity on scale and magnetic north deviation. There became a reason to improve attitude and conduct in their forest. Communication class, and school officials, reflected on the best wording for land-use signs, inviting voyeurs but reducing impact. Students observed with a soil penetrometer that paths became compacted, hence worded "Stay on the Trail" and discussed other impacts. (Later they will be adding woodchips to the path.)
In general students were taught to:

- state the problem
- treat the problem analytically
- solve the problem
- review, examine other options, and make improvements

Outreach: BLI progressive forestry policy has been edited and expanded as a result of interaction with local farmers, consumers and educational institutes. BLI has generated several curricula combining NYSED standards with the practical useful activity of managing the school woodlot. A friendly relationship has been maintained among BLI staff and member of the community, school board, teachers, and student population. The local press is fond of publishing our youth activities. Their land-use signs will continue to edify visitors.

7. CONDITIONS

This particular 52 year-old plantation included a few scotch pine, mostly red pine, but fortunately includes a couple rows of planted red oaks. The oaks and pine are nearly identical in size and mortality rate (10%). Of course the oaks are much more valuable. Their success indicates hardwoods enjoy being mixed with conifers.

We had good conditions for tree planting, with weather that was not too dry. The conifer plantation had a poor, shallow soil, and without the ecological and soil structure provided by the now well-rooted trees, conditions at the site would have been difficult. Roughly circular "holes" were cut in the existing canopy, dropping the red pines to the center of the clearing if possible. Leaving downed trees in the clearing reduces deer browse and adds organic matter. In the nutrient budget, these logs were worth less than a bag of compost and this soil really needed organic matter. The diameter of the gap left in the canopy equaled the height of the surrouding trees, the perfect nursery for black locust seedlings which established well, and are expected to grow rapidly. Planting in early December, enough snow was on the unfrozen, not-dry soil, that the seedling were not watered.

However, it would usually be best to water them.8. ECONOMICS

This project relied upon the resources of the Black Locust Initiative and upon external funding provided by this SARE grant. Developing resources for the future requires an appreciation of long-term economics, as well as the creativity to implement low-cost, effective methods. By tying in with the goals of public education, the project produced direct benefit in the form of youth education. It also received support from B.O.C.E.S. to hold two fourth-grade workshops, because they dovetailed with the New York State education requirements in an outdoor setting. Students enjoyed measuring planting and fertilization. Furthermore, the woodlot on the school property is tax-exempt, a huge plus in forestry economics. Local experts provided timber cutting services and soil fertility consultation free of charge. The existing row planted pines have such low commercial value that it is easy to compare leaving a downed red pine tree to rot, with buying a bag of compost to nourish the future forest.

The economic benefit of increasing future productivity by adding calcite limestone to the soil is already clear to local farmers, who apply the material to cropland nearbyForesters will, in time, strive to maintain and improve soil productivity, in response to the declines in productivity that are expected to follow from long-term over-exploitation of forest resources. Methods can be developed now, to use the ecological stability of the Soil Conservation Service conifer plantations as a resource for selectively establishing uneven-aged plantations of mixed high-value hardwoods that will provide sustainable timber resources for future generations. By creating a successful and positive demonstration of progressive management practices for conifer plantations, we can assist and inspire local landowners to manage their woodlots in a more efficient and profitable manner. The timing of woodlot management coincides with times of available farm labor. The cash costs of seedling production, planting, and maintaining soil fertility are minimal. There is an untapped opportunity to develop the eco-nomics of growing black locust in this area.

However, random acts of conservation can have an untold effect on future environmental and social stability and we should not over-harvest the rain forest to supply durable lumber

9. ASSESSMENT

We have been pleased with the project outcome. Working at the school woodlot provided an excellent opportunity to educate area students about progressive forestry and tree cropping, and to educate collaborating adults as well. The greenhouse operation was a success, and the interior/exterior design for bottom-heated cold frames has improved our nursery capabilities. The seedlings transplanted well. We look forward to monitoring their growth. Here are a few observations that we made along the way:

Nursery management: Our nursery operation was quite successful. We identified a need for larger pots to avoid drying between waterings. We also identified a need to re-write our protocol for root-cuttings, so that a consistency of worker performance is achieved.

Stand thinning: The first step in initiating a project should be to identify property boundaries. Look

at the deed map, then try to find the corners. Realize that neighbors may become concerned about work near their property lines, if not notified prior to the workday. Bring extra felling tools, such as many wedges and a felling bar, when selectively cutting row plantations because the planting format leads to cut trees getting hung-up. It is important to use experienced fellers and to establish and maintain safety guidelines. The activity of cutting small clearings requires two skilled fellers, but moves along quickly if the trees are felled into the center of the clearing and left to compost and to discourage deer browsing. On a site with poor soil, the intrinsic value of the biomass left to compost will jump-start the process of succession to a healthy, diverse forest. So consider making a little lumber for the next farm project if it is routine for you to do a nice job with a horse and a sawmill, but leave the bulk of the planted pine biomass in the woods as a 'deposit' into your 'forest account'.

Planting: Marking seedlings with fluorescent flagging tied directly to the plant turned out to be a poor idea. In several cases, it seemed like rabbits targeted the flagged seedlings and nipped off their tops. Perhaps the flagging identifies the seedlings to wildlife as well as humans who will make a path to investigate. Because the row-plantations are so regular, we plan to establish a simple grid-locator system (row x distance) to identify the locations of our seedlings in the future.

Soil fertility: Soil amendments can be economical if they are brought into the forest on the 'back-haul,' when equipment is brought in to remove trees. Based upon soil analysis, we decided that calcitic limestone was a good investment in the future tree crop. Applied pelletized limestone seemed to wash around a little in the winter, with frozen ground and snow melt, so perhaps this should be applied in non-snow months. Next time we will consider using a larger grit calcitic limestone. The initial soil reaction will be less, but it will stay in the system longer.

Stand health: Some insects (e.g., saw flies) attack trees, especially stressed trees. Some controls are: improving soil health, increasing diversity to prevent epidemics, and providing habitat for woodpeckers. Felling trees at the right time of year can interrupt the life cycle of some insects. We are conferring with Cornell University's Entomology department and the Lab of Ornithology to improve on our techniques. Also, the practice of cutting a core sample from a tree to determine the tree's age should never be used. The method exposes the trees to pathogens and insect pests, and data interpretation is difficult, and it reduces the lumber value.

Outreach/education: The students responded enthusiastically to the hands-on education, applying math while applying calcium. Working in the school woodlot gave the students a sense of ownership and investment in their school property. Activity based learning provides hands-on projects for multi-sensory learning. The proximity of the woodlot to the classroom helped the teachers to teach ecological and mathematical scientific principles.

10. ADOPTION

We will continue to use the methods that we have outlined in this report. The techniques worked well.

Clearly the demand for straight growing locust is increasing. The reasons to continue the practice we investigated are:

- Conifer row plantings are considered nearly worthless commercially in this area, so a landowner would likely consider anything as an improvement.
- Many of the Soil Conservation Service conifer stands are biologically mature and appear to be in decline. There is also an opportunity to use our inter-planting methods to renovate over-mature Christmas tree plantations, of which there are many. The soil has been somewhat structured by the root growth of the existing trees, and cutting/replanting trees does not require stump removal such as would be the case for non-tree crops. The ecological environment provided by low-value conifer plantations is quite suitable for the selective establishment of high-value hardwood tree crops.
- The inter-planting methods are progressive, and will improve stand productivity. Silvicultural work can be done in the winter season, when farm labor is available. The remaining conifers in the thinned stand may not respond to the thinning if live branches occupy less than the top third of the stem to have a growth spurt. Seedlings in these small clearings, both planted and naturally regenerated, will soon provide healthy forest conditions for increasingly diverse, natural, straight regeneration. The remaining pines all planted on the same day will decline and provide openings for economical natural regeneration.

11. OUTREACH

The local community was directly involved with planting hardwoods and improving soil fertility, during two large hands-on workshops with fourth-graders at the Interlaken Elementary School. At the first workshop sixty students evaluated their forest ecosystem and collected soil samples that were sent to the Fertrell laboratory. After five small clearings were cut in their forest, the sixty fourth-graders returned to apply the recommended rate of limestone and plant the seedlings. Both activities were well covered in the local Free Press (enc.). In preparation for each outdoor activity, Kim Boland the fourth grade teacher, made worksheets for the other teachers and students. He is now working with the BLI to develop them into a permanent curriculum.

Community members beyond the school also became involved with the project:

- A "Learning Web" seventh grade student participated in measuring the diameters of the new clearings and perimeter tree heights with BLI and Learning Web staff.
- A small home-school group planted walnuts. A fourth grade student and her dad nailed together three downy-, one hairy- and one pileated-woodpecker nest boxes. One was made for each clearing. We discussed our bird versus borers display (enc.). We are currently working with the Cornell Lab of Ornithology and their Entomology Department, to fine tune "Birds, Insects and Forest Practices." Calcium is good for birds, as well as trees and the rest of the ecosystem.
- Progressive forest policy was presented to the South Seneca District board and administration, and we are starting to work collaboratively to develop the woodlot activities into a curriculum addressing human actions and policy affecting our environment (NYSED standard #7).
- We were asked to present "Progressive Forestry: Connecting an Education System to its

Ecosystem" with an emphasis on the black locust, at nearby Wells College.

- One cold-frame workshop building with locust was held at the nearby Trumansburg Farmer's Market.
- Alternatives High School in nearby Ithaca currently has our display focused on eco-nomics and Alternatives Federal Credit Union is advising on cost/benefit analysis of growing black locust. Our submitted curricula were well received and are undergoing editing.

12. IN CONCLUSION

We would like to extend our thanks to the SARE program for supporting our project, and to the local community for working with us to promote progressive forestry practices. We believe that we are developing good methods for improving low-value conifer plantations, producing naturally rot-resistant lumber, and bringing up a new generation of eco-conscious land managers.

Dave Gell, October, 2004.

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