Agricultural Waste Market Research Study for New York State

Part Two
Secondary Research

PREPARED FOR:

Cornell Cooperative Extension
Cornell Waste Management

IN COOPERATION WITH:

Black River-St. Lawrence Resource Conservation & Development - Agricultural Recycling Committee
AND
NYS Department of Environmental Conservation

PREPARED BY:

CANADIAN-US BUSINESS CONSULTING SERVICE
CLARKSON UNIVERSITY

MAY 14, 1996

Acknowledgments

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May 14, 1996

Dear Reader,

As a Cornell Cooperative Extension Educator from an involved major agricultural area of New York State and as an investigator in this issue of agricultural plastic film wastes, I am pleased to introduce the findings of this project and account for at least some of its creation. Intended to be applied cooperatively by those in best positions to address this issue, the project grew from team effort in Northern New York and from around the state. Such contributions of support well demonstrated benefits of networking toward common goals and it is hoped by this project's team that others will soon find ways together to apply our determinations. By such cooperation, we can all help affect improvements for our agricultural industry and our environment.

Much credit must be given the Canadian-U.S. Business Consulting Service based at Clarkson University for working in a highly professional matter for the project. The Service's staff honed project concepts and its consultants worked diligently over many months to conduct this assessment of agricultural plastic film waste. Their results stem from a high dedication to quality.

Cornell Waste Management Institute recognized the growing significance of this issue in the state over recent years and invested quality work on a broad scale to begin seeking improvement. As part of Cornell University's Center for the Environment, the Institute provided grant support to do the project along with crucial involvement of Extension Associate Jean Bonhotal. This made the project possible.

Northern New York's Black River-St. Lawrence Resource Conservation and Development Regional Project Office continues to provide a model role of integrating and organizing various stakeholder interests through its Agricultural Recycling Committee. Based on its early survey measures that identified this particular waste problem, R.C. and D. has successfully brought industry, agriculture and agencies together to get things done about it. R. C. and D. Coordinator Peter Spadora has well shown how synergy can be developed to get results, when nowadays it's often difficult for single stakeholders to achieve as much individually. The above committee plans already to be a leading user of this project's results.

Region Six N.Y.S. D.E.C. Environmental Program Specialist Lawrence Ambeau joined the effort early on through R.C. and D. and provided important oversight. Although D.E.C. presently does not regulate Agricultural solid waste management, such staff support shows that if the environment can best be served by education and problem-solving to find more environmentally-sound solutions for these plastic wastes, they support this projects type of process.

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Cornell Cooperative Extension in Sullivan County, Agricultural Agent Colleen McKeon added an insight into the economics related to farmers' use of plastic films to store forage. Some of the financial factors she identifies lead to implications for trends in the use of the plastic around the state. Others will likely find ways to apply her comparisons and conclusions to the farm financial dynamics directly tied to generating plastic wastes.

The Cornell Cooperative Extension Association of St. Lawrence County exemplified local Extension support for such projects even though the work involved was for the benefit of more areas in the state than just one county. Association volunteers from the St. Lawrence farm community clearly voted to proceed, recognizing the value such research could return locally, and for others.

Those above are still only part of the background to the project; there are many others to recognize for their contributing roles but space precludes a listing here. It's important to emphasize that cooperative efforts by others can develop applications out of this project; much like the way it was created. It works.

Now it's up to us all to work on ways to use the findings to make improvements, especially through education. The team above especially invites you to contact us about joining this effort.

Sincerely,

Stephen F. VanderMark
Cooperative Extension Agent

amr

EXECUTIVE SUMMARY

- Recyclers and manufacturers of LDPE agricultural plastic have experienced four main barriers to recycling the material, collection, transportation, contamination, and lack of end markets.

- Research at the University of Florida at Gainesville indicates that current inability to meet volume requirements makes the recycling of LDPE agricultural plastic film non-profitable in many areas of the United States.

- Research at Pennsylvania State University is examining the level of pesticide reside on the LDPE agricultural plastic film and the impact of pesticides on the recycling process.

- A cooperative effort has been established in Ontario, Canada to address problems associated with cleaning and marketing LDPE agricultural plastic film.

- Many farmers in New York state are interested in recycling as indicated by a survey conducted by the Cornell Waste Management Institute.

- Recycling programs have been developed to use more non-traditional materials in recycling and developing more products with this recycled material.

TABLE OF CONTENTS

PART TWO - LDPE SECONDARY RESEARCH

1.0 SECONDARY RESEARCH 1

1.1 LDPE Agricultural Plastic Manufacturers 1

1.1.1 Management Barriers for Manufacturers 1

1.2 Research Regarding LDPE Plastic 3

1.2.1 Clarkson University 3

1.2.2 University of Minnesota 4

1.2.3 University of Florida at Gainesville 4

1.2.4 Pennsylvania State University 5

1.2.5 Research in Ontario, Canada 6

1.2.6 Vermont Agricultural Plastics Recycling Program 7

1.2.7 Cornell Waste Management Institute 7

1.3 Recycling Programs 8

1.3.1 Alpco Recycling, Inc. 8

1.3.2 Lackie and Associates 9

1.3.3 Presto Products 9

1.3.4 Polychem Products Ltd. 9

1.3.5 Materials Exchange 10

1.3.6 Pesticide Container Recycling 10

1.3.7 Mobil Corporation 10

1.4 Distributors and End Markets for Used LDPE 11

1.4.1 Plastic Lumber Products 11

1.4.2 Asia Export & Import, Inc. 12

1.4.3 Boulder Resources, Inc. 12

1.5 Interest Groups 12

APPENDICES

Appendix A Secondary Research Contacts

Appendix B List of Interest Groups

Appendix C Directory of U.S. and Canadian Plastic Lumber Producers

1.0 SECONDARY RESEARCH

Low density polyethylene (LDPE) agricultural plastic film use is steadily growing in New York State. The primary uses of LDPE agricultural plastic film in New York State are: silo covers, silage bags, bale wrap, greenhouse covers, haylage covers, row covers, and mulch film. According to Glenn F. Rogers at the University of Vermont Extension System, stretch wrap or bale wrap is used with bales ranging from 500 to 1500 pounds, requiring from two to two and a half pounds of LDPE agricultural plastic film for full coverage. Silage bags are usually eight to twelve feet in diameter, one hundred to two hundred-fifty feet long, and weigh between 100 to 200 pounds each. Due to a noticeable increase in volume of LDPE agricultural plastic film waste, a variety of management processes are being explored. Five main segments were determined through secondary research (Appendix D) concerning LDPE agricultural plastic film. Those segments include: agricultural plastic manufacturers, research regarding LDPE plastic, recycling programs, distributors and end markets for used LDPE agricultural plastic, and interest groups.

1.1 LDPE Agricultural Plastic Manufacturers

LDPE agricultural plastic manufacturers are an important part of the management process and some are attempting to deal with the waste associated with its increased use. However, most manufacturers are only willing to managed the plastic if it is economically feasible and profitable for their organization. Currently, there are three avenues being explored by manufacturers: reaccepting the material and locating an organization who finds end markets; taking back the material and recycling it into other materials or products; or taking back the material, processing it into pellets, and selling them to organizations that convert them into products.

It is important to note that if it is economically feasible and profitable, manufacturers would be willing to participate in the management of LDPE agricultural plastic film. Without the involvement of the manufacturers, the recycling "loop" cannot effectively be closed. Closing the loop refers to an open, workable relationship between LDPE agricultural plastic film manufacturers, dealers, farmers, and end market agents. In the closed loop process, LDPE agricultural plastic film is recycled and resold for farm use.

1.1.1 Management Barriers for Manufacturers

Manufacturers of LDPE agricultural plastic film experience three barriers in the management of the material. Those barriers include: the high transportation costs associated with collecting the material; high levels of contamination; and the inability to locate end markets for this material.

Collection and Transportation

The high costs of collecting and transporting used LDPE agricultural plastic film can be attributed to several factors. These include: the level of contamination of the material; the inability to collect enough LDPE to make transportation cost-effective; and the rural locations of most collection facilities.

AgBag, Inc., a manufacturer of LDPE agricultural plastic bags in Oregon, is currently conducting a pilot program dealing with collecting and recycling these materials through their dealers. AgBag, Inc., collects the baled plastic from the dealer after a large-enough volume has been baled to make transportation to Oregon cost-effective. In New York state, there is currently insufficient volume to meet the 5,000 to 10,000 pound minimum to be cost effective.

Another manufacturer of LDPE agricultural plastic film faced with problems of collection and transportation is International Plastic Products (I.P.P.) in Newark, Ohio. This company manufactures stretch wrap for bales and is trying to offer a reclamation service to recovery facilities. Their requirements for collection are: the material must be baled or compacted and I.P.P. must be able to drop off shipments of new stretch wrap in order to justify the cost of picking up the baled (used) material. I.P.P. is only willing to transport the material from facilities that distribute I.P.P. products. After collecting the baled material, I.P.P. mixes it in with ground tires to make fence posts and other plastic lumber products. The current volume of recovered material in New York state is insufficient for I.P.P to become involved in the management process. Transportation costs are too high unless large volumes of the material are reclaimed.

Contamination

The level of contamination of used LDPE agricultural plastic film presents another barrier to recycling. AT Polymers, Inc., a manufacturer and distributor of greenhouse, nursery, and silage film, stated that mulch film and other agricultural films often have 50% or higher contamination levels by weight. Contamination comes from ultraviolet degradation, silage juices, pesticides, product residue from hay and haylage, moisture, vegetation, dirt, and sand. Because of the high amount of contamination in the collected material, manufacturers are often unable to process LDPE agricultural plastic film due to the costs of cleaning or lack of proper cleaning equipment. Moreover, a high contamination level significantly decreases the value of the material. AT Polymers stated that greenhouse and nursery films have the highest recovery rate due to the low amount of contamination.

End Markets

A third major barrier for manufacturers of LDPE agricultural plastic film is finding an end market for the recovered or recycled material. AgBag, Inc. is able to process the recovered material into pellets, but the pellets do not have the same properties as virgin plastic. The tensile strength is weaker, forcing manufacturers to "mix" the pellets with virgin plastic to achieve required quality levels. Another problem is the color of the pellets. LDPE agricultural plastic film is produced in various colors which, when recycled together, results in a gray pellet. This grayness makes the pellets unusable for producing light-colored bags. AgBag in turn sells the pellets to other companies such as Poly-America in Texas, the largest buyer of used stretch film in the United States. Handling costs increase in proportion to the amount of handlers.

If manufacturers are able to directly make usable end-products from the recovered materials in their own facilities, the entire recovery process may become more cost-effective. Once end markets can be located for most LDPE agricultural plastic films, manufacturers may become more involved in the recycling/recovery process.

1.2 Research Regarding LDPE Plastic

Research concerning LDPE agricultural plastic is being conducted at several universities, including Clarkson University, Pennsylvania State University, University of Florida at Gainesville, and the University of Minnesota. Research is also being carried out in the province of Ontario, Canada, and in the state of Vermont. Most of the effort is focused on the recycling of LDPE agricultural plastic film.

1.2.1 Clarkson University

At Clarkson University, Dr. Greg Campbell of the Chemical Engineering Department explained that there were two methods of disposal currently being researched in this field; incineration and recycling. Dr. Campbell stated that oxygen levels in an incineration facility must be satisfactory to break down the toxic compounds in pesticides into its non-toxic elements. The oxygen levels for LDPE plastic incineration are well above the standard oxygen levels required to incinerate other types of plastic (recycling numbers 1-3). Dr. Campbell also stated that recycling LDPE plastic would require washing to rid the plastic of contaminants. To rid the LDPE plastic of contaminants, the material must be washed with a strong detergent throughout the washing process. He further stated that it was not uncommon for the LDPE plastic film to be washed more than once. Dr. Campbell believes the technology for recycling LDPE plastic is available, but high costs and a lack of end markets are major obstacles.

1.2.2 University of Minnesota

Dr. Thomas Halbach, a professor at the University of Minnesota, is also knowledgeable about LDPE plastic. When interviewed, he stated most LDPE plastic was being "managed" through disposal in landfills. Dr. Halbach explained that this was the most convenient method because of the ease of compacting LDPE plastic. He is also aware of research being performed in this area at the University of Florida.

1.2.3 University of Florida at Gainesville

The University of Florida's Dr. Charles Beatty has been doing extensive research in the area of LDPE plastic recycling. His findings indicate that costs associated with the recycling of LDPE plastics and the lack of an end market are the major obstacles in the recycling of LDPE plastic. Dr. Beatty voiced concern over the negative public perception of using products made from previously contaminated materials, particularly with pesticide contamination. He stated that as LDPE plastics deteriorate from use, more virgin plastic is needed to maintain its original tensile strength. His research concluded that a LDPE plastic recycling facility would require a volume of 40,000 tons of LDPE plastic per year in order to break-even financially. Dr. Beatty indicated that only California, Florida, and Texas currently recover this amount of LDPE plastic.

Dr. Beatty suggested several possible solutions to overcome LDPE recycling obstacles. His solutions relied on the assumption that an open, workable relationship could be established between farmers, LDPE plastic recyclers, and end market agents. He suggested a "closed loop process," in which the used LDPE agricultural plastic could be recycled and resold for farm use. This process would reduce costs to all parties involved and establish an end market for the recycled LDPE plastic. Another solution required a cooperative effort between states. The solution called for a number of states to combine their LDPE plastic waste into one facility for recycling, which would facilitate the higher volume needed for cost-effective recycling. This alternative would reduce storage and processing costs.

1.2.4 Pennsylvania State University

Dr. James Garthe, Pennsylvania State University, is a member of the Pennsylvania Department of Agriculture Project. Their current study is attempting to determine if there exists a significant level of pesticides on LDPE agricultural plastic film prior to management of the material and the impact of pesticides on the cleaning process. Because of the short half-lives of most pesticides being used, the harmful compounds in the pesticides may have naturally degraded before processing occurs. Penn State is doing laboratory studies to determine if this assumption is true or if the pesticides chemically react with the LDPE agricultural plastic film. The focus of this study has been reduced from originally testing all chemicals found on their sample down to eighteen of the most common chemicals. The number of samples was reduced due to budgetary constraints, since each test on a particular chemical costs $1,500. At the time Dr. Garthe was contacted, the laboratory was still testing the samples so results were not available. This study is focused on the recycling of LDPE agricultural plastic film.

Dr. Garthe is also a member of the Public Recycling Group of Pennsylvania. The group is planning a pilot program to recycle the LDPE agricultural plastic film to begin in 1998.

Penn State's College of Agricultural Science and Cooperative Extension have published *Agricultural and Biological Engineering Fact Sheets.* These fact sheets directly pertain to plastic and possible recycling processes, primarily for agricultural plastics including LDPE agricultural plastic film. The subject matter discussed in these fact sheets include: the different types of plastic resins, recycling processes and uses, turning waste into energy, management of degradable and non-degradable mulch film, and the confusion that is associated with the environmental claims due to "green" advertising. Dr. Garthe also wrote a fact sheet to educate farmers on how to store their used agricultural plastic in order to lower contamination levels. He has also written about the recycling of pesticide containers. These Fact Sheets can be obtained by contacting:

Agricultural and Biological Engineering
246 Agricultural Engineering Building
University Park, PA 16802
(814) 865-7685
FAX (814) 863-1031

1.2.5 Research in Ontario, Canada

Stephen P. Clarke, Agricultural Engineer for the Ontario Department of Agriculture in Canada, stated that 80% of farmers surveyed in Ontario burned LDPE agricultural plastic film on-site. Only 20% of the farmers landfilled the LDPE agricultural plastic film, possibly because of the high tipping fee of $160 (CDN) per ton. The other option available to farmers is to bury the LDPE agricultural plastic film on their farms, although this process is discouraged. Using the LDPE agricultural plastic film as a source of energy is currently not a viable option in Ontario because there are no waste-to-energy plants. One option is to ship the LDPE agricultural plastic film in Ontario to one of the 136 waste-to-energy plants located in the United States.

The Ontario Ministry of Agriculture, Food, and Rural Affairs, AT Plastics, and Polychem Products, Ltd. Developed a pilot program to work with recyclers to solve the problems associated with the cleaning of LDPE agricultural plastic film and explore end use products. It was assumed that over time, 97% of the LDPE agricultural plastic film into pellets used for re-manufacturing could be recovered. However, problems were found due to the inability to clean the LDPE agricultural plastic film. Other deterrents included the high costs of collection, the lack of a reliable end use market, and ultraviolet degradation. The study recommended that Ontario farmers properly store the LDPE agricultural plastic film for future off-site recycling. They suggested that farmers dry and clean the LDPE agricultural plastic film and either bale or wrap the LDPE agricultural plastic film into rolls that could be transported to a recycling facility.

In November 1995, a collection day for LDPE agricultural plastic film was run in one area of Ontario. The film was inspected for its level of contamination and only clean and dry material was accepted. Mobil Canada was able to successfully convert the used LDPE agricultural plastic film into plastic lumber at their U.S. plant. If the used LDPE agricultural plastic film is dry, any loose debris, such as hay, sand, and rocks, can be easily removed.

Polychem Products, Ltd., processed some of the LDPE agricultural plastic film that was collected. Ron Parquette, of Polychem, stated that the company does not process LDPE agricultural plastic film on a commercial basis. The LDPE agricultural plastic film that entered his facility was contaminated. In the prewash operation, the LDPE agricultural plastic film was ground into small chips. During the wash operation, it was found that the LDPE agricultural plastic film was too dirty and needed to be washed twice. Another problem was encountered when hay rose to the surface of the washer instead of settling to the bottom.

Polychem could not recover the cost of processing when they sold the pellets. According to Mr. Parquette, the cost to purchase recycled pellets is approximately $0.28 (CDN) per pound. However, virgin plastic can be purchased for approximately $0.14 (CDN) per pound. Mr. Parquette stated that many manufacturers believed virgin plastic is of higher quality then recycled plastic. In addition, because of the lack of incentives, it is more cost

effective to use virgin plastic over recycled plastic. Polychem needs at least $250,000 (US) to adapt their facility to more effectively wash LDPE agricultural plastic film.

1.2.6 Vermont Agricultural Plastics Recycling Program

Christine Negra, of the University of Vermont Extension System, currently coordinates the Agricultural Plastics Recycling Program. This one-year program at the University of Vermont was developed to gather information and aid in initiating recycling programs for agricultural plastics. The program focuses on HDPE agricultural container recycling and LDPE agricultural film recycling. This program seeks to work with other northeastern states on long-term initiatives such as encouraging growth of private sector recycling, encouraging manufacturers' involvement in recycling, and promoting the use of biodegradable and photo-degradable plastic films.

The program recently examined agricultural plastic use by Vermont farmers. The study focused on types of LDPE plastic used in the state, quantity, disposal methods, contamination, willingness to perform certain on-farm management of the plastics, amount spent on agricultural plastic disposal, willingness to transport the used plastic, and what farmers would be willing to pay for proper management of the plastic.

The survey found that a majority of farmers are currently using LDPE plastic and that over half of them would be willing to take the necessary extra care needed to keep their agricultural films clean. Most farmers are willing to drop off their used agricultural plastics at a drop off center for recycling if no fee is charged. This willingness dropped significantly when the question was changed to reflect a moderate fee. This indicates there is little latitude for imposing fees on dairy farmers for agricultural plastics recycling.

1.2.7 Cornell Waste Management Institute

A 1994 survey by the Cornell Waste Management Institute (CWMI) in cooperation with local Cooperative Extension Associations investigated the types and amounts of plastic being used by New York State farms. The survey identified the types and amounts of contamination, current disposal methods, and the willingness of farmers to participate in collection programs. The target audiences of this survey were farmers and Cornell Cooperative Extension agricultural agents. The results showed that disposal of the plastic was a concern of the farmers. Only 7% of those who responded had access to a dealer who would take the plastic back. Fifty percent burned it in the fields or in wood stoves, 40% landfilled it on the farm or let it blow away. Eighty-five percent of the farmers would be interested in recycling if it were possible. A survey by Penn State showed similar results.

Alternative management practices have been explored by CWMI through phone contacts and literature searches. CWMI is also looking at the long term economics of substituting plastics for durable silos but the chance of changing farm management practices to decrease the use of plastics does not seen realistic. In limited situations, farmers reuse

these plastics. Factors such as contamination, storage and transportation have limited recycling efforts. There are, however, pilot projects exploring the use of washing equipment to address the issue of recyclability. Composting these plastics would be possible only if degradable plastics were more widely used. Burning the plastic silos on the farms is an unacceptable option due to the absence of air pollution controls. Landfilling may be an option, but these plastics will not decay in wither a landfill or any on-farm dump. (New York State Association for Reduction, Reuse, and Recycling Inc. 1996 pg. 4)

1.3 Recycling Programs

With increased use of LDPE agricultural plastic film throughout the United States and Canada, the amount of used material has also increased. Therefore, many firms and organizations are instituting pilot programs and recycling programs in this area to explore the opportunities. The following section will discuss some of the participants in these recycling programs.

1.3.1 Alpco Recycling, Inc.

Alpco Recycling, Inc., in Macedon, New York, has established a unique recycling program for the area. Alpco Recycling, Inc. recycles many non-traditional products and materials that other recyclers will not take, including polystyrene, books, LDPE and HDPE, banding, plastic containers, and engineered plastic.

Alpco has considered installing a system with the capabilities to recycle agricultural plastic. This system would be able to complete all steps necessary for the recycling process: grinding, sorting, and processing. The main barrier to implementing such a system is the capital cost of $1.2 million. Alpco does not believe there is enough volume to justify the purchase of such a unit. The company believes that, if an end market for this plastic is developed, it would become more attractive to recycle.

If the company had a steady supply of material that entering the facility, there might be a reason to look for or develop an end market. The material the firm currently recycles is usually supplied from industry and commercial entities, such as plastic scrap. Therefore, the incoming plastic has a low contamination level and is relatively easier to process than LDPE. Since the materials are non-traditional, there is a large supply and therefore, the cost for processing is relatively low.

1.3.2 Lackie and Associates

Lackie and Associates, Ontario, Canada, is involved with the production of products made from recycled plastic and other materials that traditional recyclers cannot process. These materials include vinyl, aluminum-based packaging, and laminated paper. Since most recyclers do not accept these materials, Lackie and Associates commonly do not have to pay for the materials they recycle.

Lackie and Associates can make custom products from a company's own plastic waste. Products it produces include composite sheeting, plastic lumber, and plastic pallets. Plastic sheeting represents over three-quarters of their sales. Major customers include agriculture (plastic lumber) and transportation and construction (sheeting).

The capacity of the plant is 10,000 pounds per hour for the production process and 7,000 pounds per hour for their grinding process. Currently, the plant is operating at or near capacity. It uses a unique process to grind, wash, pelletize, and extrude the plastic. Lackie and Associates have clients in the US and Canada and are currently developing a market in Australia.

The company is also looking into different mixes of plastic and lower-quality end products that can be made out of lower-quality recycled plastic. The firm has considered using the LDPE agricultural plastic film, but the high contamination level poses a problem. The firm cannot accept LDPE plastic with more than ten percent contamination.

1.3.3 Presto Products

Harold Silver of Presto Products, in Wisconsin, recycles warehouse plastic because it is much less contaminated than agricultural plastic. They only accept LDPE film with low contamination levels. Products produced from the recycled materials include pallets, bale guards, rain-runs, and car stops.

1.3.4 Polychem Products Ltd.

Polychem Products Ltd., in Quebec, Canada is currently working on a pilot program to bring all elements of the recycling process together. Polychem is a plastic recycler and trader in Canada. The company uses post-industrial plastic scrap and post-consumer plastic film and containers in order to market the materials to manufacturers. Custom regrinding and repelletizing are an integral part of their operation.

Polychem has traditionally not used LDPE agricultural plastic film in their process because of the high costs associated with its processing. Quality is a major determinant in finding a buyer for the plastic, so they are concerned that agricultural plastic may lower the quality of their final product.

The firm is conducting a pilot program to see if it would be economically feasible to close the loop in the LDPE agricultural plastic film management process. It plans on accepting agricultural plastic from preselected farmers and then grinding, washing, and pelletizing it. The company will then sell the plastic to a silage bag producer. This program should be concluded in April 1996.

1.3.5 Materials Exchange

There is a web site on the World Wide Web called National Materials Exchange Network (NMEN) which is funded and overseen by Earthcycle. It is a free local and international on-line marketplace. That has been used for trading and recycling used and surplus materials and goods since 1990. NMEN was designed for ease of use in trading items cross-town or even across continents. Users can instantly search an area as small as a zip code or state or as broad as all of Europe. NMEN is broken into thirty different categories. Category seven is labeled Plastic and Rubber. LDPE plastic is included in the types of plastics that are often traded through the web site. NMEN's web site address is:

http://www.earthcycle.com/g/p/_604015bb/nmen/about.html

NMEN also provides an extensive directory of environmental and recycling services in its Recycling and Environmental Services Database.

1.3.6 Pesticide Container Recycling

Through the North Carolina Recycling Association, it was discovered that Wilson County recycles pesticide containers. Their facility is capable of handling only pesticide containers that are made of HDPE plastic. Because of the high levels of contamination, chemical companies were the primary end-market user.

1.3.7 Mobil Corporation

The Mobil Corporation began a program that accepted plastic film with up to 25% contamination levels, including LDPE agricultural plastic film. The plastic was then processed into plastic lumber. However, one drawback to plastic lumber is that it weighs three times as much as wood lumber of the same size. Now the company works with plastic film, excluding LDPE agricultural plastic film, with only 5-10% contamination levels. The plastics are melted together and can be used as parking lot stoppers, park benches, and picnic tables. The plastic lumber is being used in marina docks. However, because extensive processing is required before the final end-product is produced, end-products are relatively expensive.

1.4 Distributors and End Markets For Used LDPE

Since interest in recycling plastic has grown, there has emerged a group of organizations who specialize in finding suppliers and buyers for recovered plastic. However, because of the stringent standards for agricultural plastic recycling, such as low contamination and mass quantities, many of these brokers/traders do not deal with LDPE agricultural plastic film. It should be noted, however, that the following organizations are willing to deal with the LDPE agricultural plastic film under the same stringent standards.

1.4.1 Plastic Lumber Products

The plastic lumber industry has been established since 1985 and provides an end market for many types of recycled plastic. It is growing by 40% annually and thus provides an end-market opportunity for LDPE agricultural plastic film.

Seventy firms in 29 states and four Canadian provinces produce plastic lumber (Appendix F). Many firms focus on lumber and also work with other products or services. NEW Plastics in Luxemburg, Wisconsin generates one-third of its $10 million annual revenues from plastic lumber sales. The remainder of their revenue comes from post-consumer and post-industrial plastics recycling operations. Custom-Pac Extrusion in Chargrin Falls, Ohio, makes lumber, bumpers, drum rings, garden edging, and other recycled products. The construction industry is another major market for plastic lumber. Plastic lumber has been used in projects such as marine piers and decks.

Renew Plastics, in Wisconsin, produces plastic lumber and recycled plastic products, such as boards and sheets. They only use HDPE plastic because LDPE plastic would lower the quality of the plastic in their products.

ARW, in Ohio, makes plastic lumber and tables out of recycled plastic. The company buys the plastic pelletized and uses it in production. The accepted plastic is then sold to recyclers.

Currently, there are five categories of plastic lumber:

1. Mixed plastic lumber, where the lumber is made from mixed thermoplastic scrap such as polyethylene and polypropylene.
2. HDPE lumber, composed of only high density polyethylene scrap.
3. Glass reinforced lumber, which contains a fiberglass rod through the lumber to increase stiffness and supply reinforcement. This lumber consists of both LDPE and HDPE plastic.
4. Wood filled lumber, where wood is added as a reinforcement filler.
5. Rubber plastic lumber, which contains both plastic and rubber scrap.

Nonetheless, there have been problems with plastic lumber. Product inconsistency, high cost, and lack of standards and specifications for the plastic have kept some organizations

from using plastic lumber. However, the Plastics Lumber Trade Association and the American Society for Testing and Materials are working to develop specifications for the preferred physical and mechanical properties of lumber. Rutgers University's Center for Plastic Research is looking at expanding the possibilities for plastic lumber in order to increase the market size.

1.4.2 Asia Export & Import, Inc.

Asia Export & Import, Inc. is a trader of used plastic materials. This company buys and accepts all grades of plastic including LDPE and HDPE plastic. Based in Newton, Massachusetts, the firm accepts agricultural plastic as long as it is clean, with less than 10% contamination. It prefers baled plastic, and because of storage constraints, its volume minimum is 40,000 pounds. Asia Export & Import will pick up used plastic anywhere in the U.S. The end user is in China, where most recycling occurs because the recycling laws are not as stringent, and low quality end-products, such as plastic liners, can be produced. The labor force is inexpensive, making it more economically feasible for Asia Export and Import to recycle.

1.4.3 Boulder Resources, Inc.

Boulder Resources, Inc., located in New York City, is a wholesale trader and processor of recyclable materials. The company is willing to work with any area to find a solution to the disposal dilemma of LDPE agricultural plastics. If there is sufficient volume (for example, 20 tons or more of baled material), they will pick it up free of charge and pay for the recyclable materials. Boulder is able to accept the material and find end markets for it. Boulder stated that without sufficient volume, freight costs are too expensive to make it economically efficient. Also, Boulder indicated that recovery facilities can include bales of any type of recyclable material, as long as they are separated from each other.

1.5 Interest Groups

The sharp increase in plastic recycling has led to a variety of associations and groups specifically interested in recycled plastic. These groups focus on areas such as marketing of recycled plastic products, publications, policy formation, education, and other policy issues concerning recycled plastic. A comprehensive list of both Canadian and U.S. interests groups can be found in Appendix E.

APPENDIX A
Secondary Research Contacts

SECONDARY RESEARCH CONTACTS

American Plastics Council
1275 K St. N.W., #400
Washington DC 20005
(202) 371-5319 or 1-800-243-5790
Fax (202) 371-5679
Contact: Red Cavaney

Exxon Chemical Company
Plastic Recycling Center
2560 West 5th North Street
Summerville, SC 29483-9699
(803) 851-5251
Fax (803) 851-5265
Contact: Jimmy Laur
Recycles all propylene LDPE. Must be delivered to them. Grind, wash, extrude into pellets.

Mike DellaRocco
(518) 664-8793
Member of NYS Farm Bureau Board

Ministry of Agiculture and Food
Resources Management Branch
Nepean, Ontario, Canada
(613) 258-8305
Fax (613) 258-8392
Contact: Stephen P. Clarke

Mobil Chemical Corporation
3606 Nicliolas Street
Suite 104
Easton, PA 18045
(610) 559-8476
Fax (610) 250-9409
Dan Fling
Recycles LDPE. Would be willing to attend meeting to help educate farmers.

Nation Plastics
PO Box 830028
San Antonio, TX 78283
(210) 225-5556
Fax (210) 229-1273
Contact: Jim Nation *
Accepts film if willing to ship to him. Will process it, but currently has no end market. He stores the plastic until an end market is found. Currently unprofitable for him to recycle the LDPE.

New Age Plastic Recycleers
2301 W. Sample
W. Smaple Building 3
Suite 1A
Pompano Beach, FL 33069
(305) 968-0156
Fax (305) 968-0194
Contact: Nathan Seskin
Pick up all across the country. Baled preferred, with minimal amounts of contamination. Need full truckload before it can be picked up.Wash grind pelletize.

Omni Recycling
(516) 333-5741
Processor, types 3-7 baled and sent to buyers.

Ontario Recycling Council
(416) 960-1025
Contact: Irene Suduna

Otsego County Cooperative Extension
(607) 547-2536
John Brouillette
Disposal by garbage company, recycle if clean.

SECONDARY RESEARCH CONTACTS

Otsego County Planning Department
197 Main Street
Cooperstown, NY 13326
(607) 547-4225
Fax (607) 547-6492
Heather Cunniff, Planner *
Member of the Environmental Council, dicussed plan to manage, need cost effective solution.

Pennsylvania State University
Agricultural College of Engineering
246 Agricultura Engineering Building
University Park, PA 16802
(814) 865-7154
Fax (814) 863-1031
Contact: James W. Garthe

Polychem Products, Ltd.
Montreal, Quebec
(514) 348-7392
Contact: Ron Parquette

Resouce Recovery System
(518) 296-8034
Dan Dorlan
Works with Albany and Columbia Counties.

Suffolk County Cooperative Extension
246 Griffing Avenue
Riverhead, NY 11901
(516) 727-7850
Dale Moyer
Scott Clark
Mulch film and greenhouse covers mostly landfilled.

Tech Polymers, Inc.
2064 Elsa Avenue
North Naples, FL 33942
(813) 597-2000
Fax (813) 597-2312
Contact: Marcel Vezina
No longer deals with agricultural plastic. Lost $2.5 million attempting to recycle into cradles. Believes to be successful need support from the government at all levels and from the plastic producers.

Wilson County Recycling Department
North Carolina
(919) 399-2823
Contact: Jan Manning
Recycle pesticide containers and market the pellets to chemical companies.

APPENDIX B
List of Interest Groups

INTEREST GROUPS

American Plastics Council
Contact: Red Cavaney
1275 K St. N.W., #400
Washington, DC 20005
(202) 371-5319
(800) 243-5790
Fax: (202) 371-5679
Description: APC is a joint venture with the Society of Plastics Industries which brings together the interests of 25 companies within the plastics industry. This group works to address the environmental impact of plastics and its role in integrating resource management.

Association of Municipal Recycling Coordinators
Contact: Linda Varangu
25 Douglas Street
Guelph, Ontario
Canada, N1H 2S7
(519) 823-1990
Fax: (519) 823-0084
email: amrc@web.apc.org
Description: AMRC is a not-for-profit organization formed in 1987 by municipal waste management professional to facilitate the sharing of municipal waste reduction, reuse, composting, and recycling information, expertise and experience among municipalities.

Canadian Association of Recycling Industries
Contact: Donna Turner
50 Gervais Drive, #502
Don Mills, Ontario
Canada M3C 1Z3
(416) 510-1244
Fax: (419) 510-1248
Description: CARI promotes net economic and social impact from commercial activities.

Canadian Plastics Institute
1262 Don Mills Road, Unit 48
Don Mills, Ontario
Canada, M3B 2W7
(416) 441-3222
Fax: (416) 441-1208
Description: Collects information on companies in Canada who are involved in the recycling process of both post-consumer and post-industrial plastic waste. Information gathered includes: collection, transportation, marketing of recycled materials, equipment for recycling, manufacturers of recycled products, and service organizations.

Mid-Atlantic Recycling Consortium
Contact: Nancy Williams
P.O. Box 1009
Richmond, VA 23240-0009
(804) 762-4570
Fax: (804) 762-4453
Description: A Consortium of recycling and economic Development officials that attempts to enhance the region's markets for recyclables through economic development.

Mid-American Council of Recycling Officials
Contact: Laura Kliewer
641 East Butterfield Road, #401
Lombard, IL 60148
(708) 810-0210
Fax: (708) 810-0145
Description: Develops regionally effective programs and policies in recycling, recycling market development, and source reduction.

INTEREST GROUPS

Mid-Continent Recycling Association
Contact: Martain Scock
P.O. Box 5520
Bismark, ND 58502
(701) 221-5170
Fax: (701) 221-5200
Description: Fosters regional cooperation in development of recycling, marketing, formulation of policies, and procurement of recycled products.

New York State Association for Reduction, Reuse and Recycling
Contact: Ed Marr
26 Harvester Ave.
Batavia, NY 14020
(716) 344-4035
Fax: (716) 344 4037
email nysar@recycle.net

Northeast recycling Council
Contact: Edward Boisson
139 Main Street, #401
Brattleboro, VT 05301
(802) 254-3636
Fax: (802) 254-5870
Description: Association of northeast officials which assist in the expansion and ensuring the long term viability of recycling so as to obtain its full source conservation and economic benefits

Ontario Waste Management Association
Contact: Nancy Crawford
4198 Dundas Street west, #320
Etobicoke, Ontario
Canada M8X 1Y4
(416) 236-0172
Fax: (416) 236-0174

Plastic News
Contact: Tom Ford
1725 Merriman Road
Akron, OH 44313
(216)836-9180
Fax: (2165) 836-1005

Plastics Recycling Foundation
Contact: Wayne Pearcson
135 East State Street
Kennett Square, PA 19348
(215) 444-0659
Fax: (215) 444-0923

Plastic Lumber Trade Association
Contact: Patricia Smith
540 South Main Street
Building No. 7
Akron, OH 44311-1010
Description: Helps develop specification of plastic lumber. Establish design guide lines for plastic lumber products and attempts to resolve issues regarding proper test methods on flammability, fasteners, and long term creep characteristics.

Western States Recycling Coalition
Contact: Bill Hull
121 2nd Street, 4th floor
San Francisco, CA 94105
(415) 974-6422
Fax: (415) 974-1747
Description: Manages the exchange of information on regional and national recycling policy. Establishes relationships among legislative and executive officials concerned with recycling.

INTEREST GROUPS

Recycling News
Contact: Dan Kennedy
1625 Ingleton Avenue
Burnaby, BC V5C 4L8
(604) 291-9900
Fax: (604) 291-1906

Recycling Today
Contact: Ann Claire Boughton
4012 Bridge Street
Cleveland, OH 44113-3320
(216) 961-4130
Fax: (216) 961-0364

Recycling World
Contact: Chris Floate
Hilltop, Off Church Road, Wenheath
Redditch, Worcestershire, England, B97 5PQ
+44-1527-404550
Fax: +44-1527-404644
Description: This magazine covers all aspects of trade recycling in the United Kingdom. All material types are covered. The group publishes a handbook once a year.

APPENDIX C
Directory of U.S. and Canadian Plastic Lumber Producers

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

AERT
PO Box 1237
Springdale, AR 72765
(501) 750-1229
fax (501) 750-1322

ARW Polywood, Inc.
PO Box 277
Lima, OH 45802-0277
(419) 224-2283
Fax (419) 229-5102
Contact: Adam Wright
Dimensional and round lumber, picnic tables, benches.

Aeolian Enterprises
1 Lloyd Ave. Place
Latrobe, PA 15650
(412) 539-9460
Fax (412) 539-0572
Contact: Earle Stephenson
Lumber, fencing, decking.

Aldan Lane Company
2148 W. Highway 22
Kalona, IA 52247
(319) 656-3620
Fax (319) 656-3656
Contact: Cloyce Palmer
Lumber, shapes, sheet.

American Eco Board Inc.
200 Finn Court
Farmingdale, NY 11735
(516) 753-5151
Fax (516) 753-5165
Contact: Ron Kwiatkowski
Dimensional lumber, picnic tables, car stops, benches, planters.

American Recreational Products
30-1 Raynor Ave.
Ronknokoma, NY 11779
(516) 588-4545
Fax (516) 737-8431

BTW Industries
2000 S.W. 31st Ave.
Pembroke Park, FL 33009
(305) 962-2100
Fax (305) 963-4778

Bedford Industries Inc.
1659 Rowe Ave.
Worthington, MN 56187
(507) 376-4136
Fax (507) 376-6742
Contact: Bob Hill
Dimensional lumber, tire stops.

Cascades Re-Plast Inc.
1350 chemin Quatre Saisons
Notre Dame du Bon Conseil, PQ J0C 1A0
(819) 336-2440
Fax (819) 336-2442
Contact: Jean-Guy De Charette
Lumber, park equipment, benches, picnic tables, flower planters, trash receptacles.

Collins & Aikman
311 Smith Industrial Blvd.
Dalton, GA 30722-1477
(706) 259-9711
Fax (706) 259-2099
Contact: Larry Umstadter
Industry flooring blocks, parking bumpers, guard rail offset blocks.

Coon Manufacturing
202 C St.
Spickard, MO 64679
(816) 485-6299
Fax (816) 485-6122
Corrugated board, sheet, tree liners, buckets, feeders, floats, mail boxes.

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

Custom-Pac Extrusions Inc.
16865 Park Circle Drive
Chagrin Falls, OH 44023
(216) 543-8284
Fax (216) 543-7636
Lumber, custom profiles

DuraTech Industries
1138 4th Ave.
Lake Odessa, MI 48849
(616) 374-0240
Fax (616) 374-0907
Contact: Michael Ender
Lumber, site amenities (tables, benches, etc.).

Eaglebrook Plastics, Inc.
2600 W. Roosevelt Road
Chicago, IL 60608
(312) 638-1600
Fax (312) 638-2567
Contact: Mike Dahl
Lumber, custom profiles, furniture.

Earth Care Products
2300 Glades Road 440 W.
Boca Raton, FL 33431
(800) 65-EARTH
Fax (407) 394-5335

Ecopal Canada, Inc.
565 Arvin Ave.
Stoney Creek, ON L8E 5N7
(905) 643-6955
Fax (905) 643-3431
Contact: Herbert Hoedel
Shipping containers, pallets

Eco-Tech L.P.
4004 Dayton St.
McHenry, IL 60050
(815) 363-8570
Fax (815) 363 8594
Contact: Joseph Sadlier
Pallets, lumber, docks, tables

Elsro Construction Products
38 Rayborn Crescent
St. Albert, AB T8N 5B4
(403) 458-8773
Fax (403) 458-1173
Contact: Ed Forster
Guard rail posts, curbs, floor and roof tiles.

Environmental Plastics
4981 Keelson Drive
Columbus, OH 43232
(614) 861-2107
Fax (614) 445-6907

Environmental Recycling
8000 Hall St.
St. Louis, MO 63147-2444
(314) 382-7766
Fax (314) 382-7711

Environmental Recycling
83 N. Edmore Lane
West Islip, NY 11795
(516) 669-2037
Fax (516) 669-2037
Contact: Carl Lanza
Picnic tables, park benches, car stops, speed bumps, docks, lumber.

Envirowood Inc.
501 W. Algonquin Road
Mt. Prospect, IL 60056
(708) 981-0310
Fax (708) 981-0315
Contact: Dan Pastor
Lumber, car stops.

Epic Plastics
1880 Garden Tract Road
Richmond, CA 94801
(510) 235-9339
Fax (510) 235-9356

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

Everwood Industries
RR 2
St. thomas, ON N5P 3S6
(519) 633-5168
Fax (519) 633-2589
Contact: Ron Kowalski
Farm posts.

Futureplast Technologies
9915 76 Ave.
Edmonton, AL T6E 1K8
(403) 439-6618
Fax (403) 439-3521
Contact: Ronald Jaehn

Global Plastics
3400 Peachtree Rd. N.E., Suite 741
Atlanta, GA 30326-1107
(404) 239-6270
Fax (404) 239-6284

Global Plastics Recycling
2350 Foreman St.
Cayce, SC 29033
(803) 796-0049
Fax (803) 796-6677

Goodwill Industries
4940 Bayline Drive
North Fort Myers, FL 33917
(813) 995-2106
Fax (813) 995-5868

IPI
PO Box 2000
Kendallville, IN 46755
(219) 347-5610
Fax (219) 347-8200

International Plastics Corp.
111 Patton Court
Nicholasville, KY 40356
(606) 887-2877
Fax (606) 887-2656

Iowa Plastics Inc.
322 N. Main Ave.
Sioux Center, IA 51250
(712) 722-0692
Fax (712) 722-0692
Contact: Virgil Houtkooper
Plastic sheets.

Jeanell Sales Corp.
PO Box 537
Sharon, TN 38255-0537
(901) 456-2681
Fax (901) 456-2252

Kirtland Manufacturing
PO Box 2035
Staunton, VA 24402
(540) 885-7686
Fax (540) 885-8760

Knotwood Plastic Products
11652 Camden Ave.
Omaha, NE 68164
(402) 493-3142
Fax (402) 493-3142
Contact: Warren Manners

MBX
PO Box 929
Wausau, WI 54402-0929
(715) 845-1171
Fax (715) 848-1054

Metro Plastics
4680 95th St. S.W., Bldg. 6
Tacoma, WA 98499
(206) 588-2921
Fax (206) 588-3039
Contact: Koree Frank
Dimensional lumber, fence posts.

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

Mobil Chemical Co.
Composite Products
80 Connecticut Ave.
Norwalk, CT 06856
(203) 289-8739

N.E.W. Plastics Corp.
PO Box 480
Luxemburg, WI 54217-0480
(414) 845-2326
Fax (414) 845-2439
Contact: Irvin Vincent
Decking, walkways, manure spreaders, hand rails, fencing, picnic tables, benches, spreader bars.

Obex, Inc.
PO Box 1253
Stamford, CT 06904
(203) 975-9094
Fax (203) 975-9403
Contact: Celeste Johnson
Landscape ties, compost bins, raised garden beds, sandboxes.

Omnitrax
252 Clayton, 4th Floor
Denver, CO 80206
(303) 393-0033
Fax (303) 329-3979

Packing Material Co.
27280 Haggerty Road
Farmington Hills, MI 48331
(810) 489-7000
Fax (810) 489-7009

Phoenix Recycled Plastics
225 Washington St.
Conshohocken, PA 19428
(610) 940-1590
Fax (610) 940-1593

The Plastic Lumber Co.
540 S. Main St., Bldg. 7
Akron, OH 44311
(216) 762-8989
Fax (216) 762-1613
Contact: Alan Robbins
Lumber, picnic tables, park benches, trash cans, pallets, boat docks, speed bumps, signs.

Plastic Pilings Inc.
1485 S. Willow Ave.
Rialto, CA 92376
(909) 874-4080
Fax (909) 874-7603
Contact: Andrew Barmakian
Pilings, camels, chocks, dimensional lumber.

Plastic Recycling Inc.
10252 Highway 65
Iowa Falls, IA 50126
(800) 338-1438
Fax (515) 648-5074
Contact: Thomas Imperato
Tables, benches, pallets, car stops, posts, lumber.

Plastic Recycling Inc.
Business Route 404 W.
Denton, MD 21629
(800) 338-1438
Fax (515) 648-5074

Plasticycle Products Ltd.
4822 Centre St. S.
Calgary, AB T2G 5A4
(403) 243-0021
Fax (403) 243-4689
Contact: Jim Van Wert
Lumber, car stops, tables, docks, planters, horse stalls, benches.

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

Plastic-Ro International
12885 Jean Grou
Montreal, PQ H1A 3N6
(514) 255-7714
Fax (514) 644-3115

Poly-Wood
207 N. Huntington
Syracuse, IN 46567
(219) 457-3284
Fax (219) 457-4723

Polywood Enterprises
PO Box 547
Findlay, OH 45839
(419) 424-570
Fax (419) 424-5703

Reconversion Technologies
1709 Highway 36 N.
Brenham, TX 77833
(409) 830-1367
Fax (409) 830-8546

Recycled Plastic Industries
1011 McDonald St.
Green Bay, WI 54303
(414) 433-0900
Fax (414) 433-9329
Contact: Las Anderson
Dimensional and custom profiles.

Recycled Plastic Man
5880 Denison Dr.
Venice, FL 34293
(813) 497-1020
Fax (813) 497-7186
Contact: John Spencer
Lumber, car stops, park benches, picnic tables, bollards.

Recycled Plastic Products
2331 W. Hampden Ave., #148
Englewood, CO 80110
(303) 7873-0088
Fax (303) 783-0200
Contact: Bob Williams
Fencing materials (posts, rails, pickets, caps).

Renewed Materials Industries
621 W. Division St.
Muenster, TX 76252
(817) 759-4181
Fax (817) 759-4011
Contact: J'Lynn Hare
Landscape edging, traction boards, roofing shingles.

RePlas Products
300 Thomas Ave., Bldg. 201
Williamstown, NJ 08094-3442
(609) 262-1398
Fax (609) 262-1399
Contact: Jeff Lucas
Carpet installation products, sound barriers, large enclosures.

Seaward International
PO Box 98
Clear Brook, VA 22624-0098
(800) 828-5360
Fax (540) 667-7987
Contact: Tim Batchelor

Somerset Plastic Recycling
1400 Brayton Road
Somerset, MA 02725
(508) 673-6201
Fax (508) 677-0997

Standridge Color Corp.
PO Box 1086
Social Circle, GA 30279
(404) 464-3362
Fax (404) 464-2202

U.S. AND CANADIAN PLASTIC LUMBER PRODUCERS

Superwood of Alabama
PO Box 2399
Selma, AL 36702
(205) 874-3781
Fax (205) 874-7348
Contact: Floyd Plummer
Lumber, car stops, outdoor furniture.

Trimax Plastic Lumber
2076 Fifth Ave.
Ronkonkoma, NY 11779
(516) 471-7777
Fax (516) 471-7862
Contact: Anthony Noto
Structural plastic lumber for piers,, decks, docks, picnic tables, benches, fences, utility poles.

United Resource Recovery
6734 Highway 141 N.
Jonesboro, AR 72401
(501) 932-350
Fax (501) 932-3573
Contact:. Marcel Jasinski
Stepping stones, custom products.

Westmont Building Products
200 E. Quincy St.
Westmont, IL 60599
(708) 968-3420
Fax (708) 968-0285

Wonderwood Industries Inc.
PO Box 912
Leeds, AL 35094
(800) 299-2212
Fax (800) 299-2212
Contact: Ray Donaldson
Lumber and sheet.

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Clarke, Stephen P. "Prospects and Problems with Plastics in Agriculture." Resources Management Branch, Ministry of Agriculture and Food. Nepean, Ontario, Canada. 1992

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