Executive Summary
The University of Iowa Office of Utilities and Energy Management, in coordination with the Office of Sustainability, requested an analysis of the market feasibility to source approximately 100,000 tons annually of wood chip biomass for use in the university power plant. This request is a direct result of the University of Iowa’s 2020 Sustainability Targets, which state that “we will increase the use of biomass, geothermal, solar, wind, landfill gas, gasification and other emerging energy alternatives to achieve the goal of 40% renewable energy consumption on the campus by 2020.” Such biomass will partially replace coal in one of the three plant burners. Biomass must be sourced locally (within a 50 mile radius of Iowa City), competitively priced, sustainably farmed, and delivered reliably to the university power plant.

The Team has undertaken a project to analyze the market and candidate sources of biomass, determine a viable business entity to manage the operations (such as a private company or new farmer’s cooperative), and research best practices.

Best Practices Research
The project started with an analysis of best practices in sourcing biomass, and research into similar projects. The Team researched biomass sourcing at the Universities of Montana, Idaho, South Carolina, Missouri as well as Iowa State, Purdue, and Colorado State. The University of Missouri is the best example for Iowa, because the institution seeks 100,000 tons of wood chips annually and is situated in similar geographic and climatic zones. Missouri will source one third of their needs from each waste stream, new growth, and forestry management. New growth will occur on flood plain land, which will generate between 9 and 13 tons per acre within three years. The Team also contacted Dr. Richard Hall at Iowa State University. Dr. Hall is an expert in biomass sourcing and is a knowledgeable resource willing to assist with the project going forward.
Land Analysis
After completing best practices research, the Team analyzed candidate sources for biomass proximate to the University of Iowa. Using land census data from the ten counties surrounding Iowa City, the Team determined that there are over 900,000 acres of farmland not used for row crops. There are an additional 600,000 acres of non-farmland within the ten county region, and over 520,000 acres of non-crop, non-CRP land in the ten-county area. The Team also analyzed the Clear Creek watershed within Johnson County. This watershed, which encompasses over 66,000 acres, is adjacent to Iowa City and contains 23% ungrazed grassland and 8% deciduous forest. It is also home to the Amana Society and a significant portion of flood plain and “river bottom” land unsuitable for farming row crops. Sourcing new growth trees as well as biomass from forestry management is very likely within Clear Creek.

Market Analysis
The Team reached out to the local market to determine interest and feasibility. On March 2, 2011, the Team held a conference call with Gary Swenka, the president of Consumers Cooperative in Coralville. While farmers may be interested in biomass sourcing, they would be unwilling to switch from row crops or allow CRP land to be used upon contract expiration. Management of forested acres or growing trees on flood plain land unsuitable for farming are the most viable options. A private entity or new cooperative will need to be established for the purpose, and should be closely managed by the University. On March 4, 2011, the Team held a meeting in Amana, Iowa with representatives from Amana Farms Inc., Iowa Valley RC&D, and USDA/NRCS. There is strong interest in the project and future collaboration is likely. Consistent with previous information, the Team learned that “river bottom” or flood plain land is the best option for new growth biomass. Forestry management, especially on lands owned by Iowa DNR or Amana Farms Inc., is very viable. Amana Farms already sources significant wood through managing their own forests, and owns many acres of river bottom land. Participants reiterated that a private business entity will be needed for harvest, chipping, storage, and transport.

Project Lifecycle
The overall project to supply the University of Iowa with a reliable, sustainable source of biomass for fuel is quite large and broad. Due to this fact and the constraints of the project being within an eight-week course in the MBA program, the Team was able to focus on a few steps of the overall project, so that the Team could make contacts with key players, and then the later steps could be completed. Below we will highlight all of the large phases of the overall project that will need to happen for this project to become a reality.

1. Identify the University’s needs for biomass fuel.
2. Identify type of biomass fuel and machine specifications.
3. Identify the market for biomass.
4. Reach out to contacts within each market.
5. Create a business model.
6. Solve project logistics.
7. Create boundaries within which to produce fuel.
8. Sign up fuel producers into contracts.
1. **Identify the University’s needs for biomass fuel.**
   This step of the project was completed by the University of Iowa Facilities Management, who told the team that to meet the 2020 Sustainability Goals, the University would need the equivalent BTUs of 100,000 tons of woody biomass per year to fuel the power plant.

2. **Identify type of biomass fuel and machine specifications.**
   The University houses three boilers at the power plant which heat the entire campus. The Team was specifically looking at one boiler which currently uses coal, but will eventually be using biomass as fuel. Due to the specifications of this particular boiler, the University needs a source of biomass that resembles coal both physically and how it burns (BTUs). The biomass would need to resemble coal due to the fact that the fuel would need to be loaded into the boiler in a similar fashion (as an example, this boiler would not be able to use oat hulls as fuel because they would not be dense enough). The University determined that biomass made from wood would be the best source of fuel, as it has a similar burn rate, physically resembles coal, and can be grown in the area. The University is open to have any type of wood used as biomass, as long as it is able to have the needed BTUs and size.

   The University also specified that it would need 100,000 dry “bone-dry” tons of woody biomass per year, which would give the University the required amount of BTUs. If any of the wood were to have moisture in it, the BTU level would decrease, and hence, the number of tons needed would increase. For example, if the University were to be supplied with wood that had 10% moisture content, it would now need 110,000 tons of woody biomass to supply the number of BTUs for the year. Similarly, if the University were supplied with wood that were 50% moisture, that number would be 200,000 tons. The point about the inverse relationship between moisture content and amount of wood needed is very relevant, in that the University will need to plan for either having the logistics solved so that the wood will be completely dry when it reaches the power plant, or, that it will need to have additional acres supplying woody biomass to make up for any moisture content.

   One process that may be able to harvest woody biomass in the manner that would meet the University’s needs would be torrefaction. Torrefaction processes wood into dense pellets that would be able to have similar burn rates as coal, and also are able to be handled similarly as coal.\(^1\)

   During the Team’s research, they found that the University of Missouri was working with New Holland to use machines that were able to harvest the tops off of trees to use for biomass. In addition, the University indicated that it has a contact at Roto Chopper (Sales Representative Steve Pieper, (608) 486-2851, spiiper@rotochopper.com, www.rotochopper.com) whom they have been working with to identify machinery that would be able to harvest wood to their specifications.

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2. [http://torrefication.blogspot.com/](http://torrefication.blogspot.com/)
3. **Identify the market for biomass.**
   The Team spent the first part of the project identifying best practices in using biomass as fuel. After identifying the best practices, the team then went on to identify the specific markets/channels that would be able to provide the woody biomass for the University. Outlined in the report below is a list of many possible sources of biomass for the University. However, the Client indicated that it wanted the Team to spend its time specifically researching biomass from local farmers, as that would be the most beneficial use of our time for the Client. The majority of the following report is information we found when identifying local markets/channels, as well as contacts within those markets. However, we will list below all possible channels from which the University may be able to acquire woody biomass:

   **Growing woody biomass:** The following report will identify potential markets for growing woody biomass in the ten counties surrounding and including Johnson County. The potential suppliers would be local farmers both in the area, and specifically in the Clear Creek Basin. In addition, Amana Farms, Inc., the largest land owner in the state of Iowa, would also be a potential supplier of woody biomass. The team found that approximately 9-13 tons could be harvested per acre every three years that grew trees.

   **Forestry management:** In addition to growing woody biomass, there is also the opportunity for the University to get biomass from forestry management. This would include cleaning up unneeded wood from forested areas, as well as tree removal from ditches and fences. The Team researched that approximately 30 tons of woody biomass could be harvested every 25 years from an acre of forested land.

   **Factory waste:** The team identified several sources of woody biomass that would come from local factory waste. Specifically, there are several loggers in the area, as well as HNI Corporation in Muscatine, Iowa, which manufactures office furniture. In addition, the team identified another factory in the area that produces approximately 80,000 tons of cardboard waste ("cardboard sludge") each year. While the Team did not research the factory waste channels, per the direction of the Client, these are very possible sources of biomass as well.

   **Waste stream:** A fourth channel that may be able to provide biomass to the University is the local waste stream. Every year, thousands of tons of woody biomass make their way to the local landfill, including discarded Christmas trees and fallen branches after storms. In addition, the Team found that local tree removal services dispose of some of their wood chips by sending them to the landfill. The University may want to tap into this source of woody biomass as well.

4. **Reach out to contacts within each market.**
   The Team spent a large portion of the project contacting representatives from possible suppliers, as well as state and national regulators and the customer. Specifically, the Team contacted the head of a local Farmer’s Cooperative, a representative of Amana Farms, Inc., and representatives from the Iowa Valley RC&D and the USDS Natural Resources Conservation Service. The following report outlines the information that the Team found from these contacts.
5. **Create a business model.**
   After the market is identified and contacted, the Client will need to have a viable business model to be the middle man between the University and the suppliers. The Team reached out to the Entrepreneurial Center at the Pappajohn Business Building, and they suggested that the Client has four options:
   
   a) Add a new state employee staff under Facilities Management to manage this project  
   b) Create a non-profit with input from the University  
   c) Create a private company/LLC  
   d) Utilize a private wood chip company to expand and handle all logistics

6. **Solve project logistics.**
   Whichever business model is created, that business entity will need to solve the project logistics, including the harvesting of the wood, storage, drying, and transportation to the University.

   **Harvesting:** Several of the contacts interviewed by the Team were very clear in suggesting that whichever business entity is created should be in charge of buying and maintaining machinery, as well as harvesting the wood. All contacts stated that they did not think that local farmers would participate in supplying wood for the University if they would also be responsible for harvesting that wood.

   **Storage:** In addition, the business entity would be responsible for storing the wood at an off-site location. Due to the nature of wood, one contact suggested that a storage facility would need to be built specifically for the wood chips, as they would rot if simply left to dry in the open air, and did not think they would be able to be stored in current storage facilities that store corn and beans.

   **Drying:** As mentioned above, the wood that is desired by the University will be at or near “bone dry”, so the wood would need to be dried after it is harvested. Most likely, whatever storage facility that is created would also be able to dry the wood through means of heaters.

   **Transportation:** The business entity would also need to determine how the wood chips would be transported to the power plant. Due to the location and lack of storage at the power plant, the wood chips would need to be delivered in a “just-in-time” model. Most likely, the business entity would be contracting the transportation out to a third party vendor.

7. **Create boundaries within which to produce fuel.**
   Due to the fact that the goal to fuel the University with biomass comes from the 2020 Sustainability Goals, the Client would not want this biomass to be produced unsustainably. For example, the University would not want the woody biomass to be produced by cutting down old growth forests. Hence, the University will need to create the boundaries around which this fuel will need to be created, and determine how those guidelines will be met and enforced (for example, audited by the business entity, or audited by the University?).

8. **Sign up fuel producers into contracts.**
   Finally, after the contacts are made, business entity is created, boundaries are created, and logistics solved, the University will need to sign up the fuel producers into long-term contracts for supplying fuel. This will most likely be done in conjunction with the business entity.
Specific Work Completed within Steps of the Project Lifecycle

As mentioned above, the Team worked over the eight weeks on a few steps of the Project Lifecycle so that the Client would be able to have the contacts to carry the project forward. Specifically, the Team worked on Steps 2-5. Below you will find the work that the Team completed, along with contact information, pertaining to those four steps of the Project Lifecycle.

2) Identify Type of Biomass Fuel and Machine Specifications.

Best Practices Research: Biomass Sourcing at other Institutions
Several universities have started burning biomass (including woodchips) for energy, and many more are in the planning phase for doing so in the future. However, many of the larger universities that are currently doing this have unique ways of obtaining wood chips that are not necessarily viable options for the University of Iowa. For instance, the University of Montana, University of Idaho, and the University of South Carolina have contracted out with timber and logging companies to use their “slash” material, (branches, bark, and leaves left behind after timber harvesting). Another example is that of Colorado State University, where they are cooperating with the Colorado State Forest Service in their efforts on large-scale “forest management” to prevent forest fires. Several universities are also using corn stover as a source of biomass (or are at least interested in doing so,) including Eastern Illinois University and the University of Missouri.

University of Missouri
In order to learn more about the current state of the University of Missouri’s biomass efforts the Team contacted State Forestry Extension Specialist Dr. Hank Stelzer (stelzerh@missouri.edu) and University of Missouri Power Plant Superintendent Greg Coffin (coffing@missouri.edu). We received a response from Dr. Stelzer stating his feeling that Missouri was still early enough in the process that they were not in a position to provide a lot of guidance. He referred us to Dr. Richard Hall, a Professor in Iowa State University’s Department of Natural Resource Ecology and Management. Dr. Stelzer reported that Dr. Hall had been researching woody biomass since the 70’s and had been of tremendous help in Missouri’s efforts.

The University of Missouri is the best example of a large university in a similar situation to that of the University of Iowa. Missouri will be providing power to their campus by burning biomass in a new boiler, which will necessitate 100,000 tons of biomass per year (the same amount that will be needed at the University of Iowa.) They are also similar in that they are in a comparable geographical area to that of the University of Iowa, sharing many of the same types of resources and geography.

Missouri intends to source 100,000 tons annually using three different sources. One third will come from “waste stream sources-mills, chopped pallets, development clearing, tree trimming and ice storm damage.” Another third will come from forestry management and thinning efforts. The final third will come from growing biomass. The last two sources are along the same lines as what is being explored by the University of Iowa: forestry management and growing biomass.

Below are key points from “University Sees Biomass as Future for Energy Generation”3, an article about the University of Missouri’s biomass efforts, and how they are applicable to the University of Iowa:

3 http://biomassmagazine.com/articles/3913/university-sees-biomass-as--future-for-energy-generation/
The University of Missouri is exploring options to grow woody biomass on areas affected by the flooding in 1993, which is similar to some farm ground in the Iowa City area. Due to the fact that the Missouri soil now has a profile that features a deep sand formation, it is no longer suited for row crops, but is ideal for growing trees such as willow and cottonwood. Growing trees on this flooded land may allow farmers to regain lost production acres.

The University of Missouri started testing different species of cottonwood and hybrid poplar in the late 1990s, and has identified several varieties that are well-suited to the soil conditions of Missouri.

The current thought is to cut the tops of the trees after the first year, to promote multiple sprouts. The trees will then grow for three more years to reach a height of 20 feet with several stems. They will be able to harvest these trees every three years, or approximately six times during the lifecycle of the tree.

They estimate that they will be able to produce 9-13 tons of woody biomass per acre at the end of three years.

With the power plant paying $35 per ton of woody biomass, this may generate between $315-473 in revenue per acre for farmers.

The researchers have been working with New Holland, an agricultural equipment manufacturer, which has developed equipment that can be fitted onto a forage harvesting machine. This machine clips the heads off of trees, which are then fed into a chipper, chopping the tree into small pieces.

Current Status: We are following up with Dr. Stelzer and Greg Coffin to determine the current status of Missouri’s pilot project in New Franklin, MO.

Iowa State
After being referred to Dr. Richard Hall (rbhall@iastate.edu) we reached out and made contact with him. Dr. Hall was very receptive to the idea of sharing his expertise and said he’d be happy to help as much as he can. He proceeded to email to us a report he had done in cooperation with Lisa Schulte, John Tyndall, and Kumudan Grubh entitled “Rapid Assessment of Woody Biomass Capabilities in Three Regions of the U.S. Midwest,” which includes research on the potential of growing and harvesting woody biomass in Eastern Iowa, among other areas.

Current Status: We received a commitment from Dr. Hall to arrange a conference call with our team after we read his report and generate follow-up questions. Members of our team are currently reading the report and we intend to set up a conference call with him in the coming weeks.

Purdue
In order to learn more about the current state of the University of Missouri’s biomass efforts, we contacted the head of Purdue University’s Energy Frontier Research Center, Dr. Maureen McCann (mmccann@purdue.edu) as well as Dr. Nick Carpita (carpita@purdue.edu), a Professor in Purdue’s Department of Botany and Plant Pathology. Dr. Carpita responded and stated that he actually works primarily with switch grass and other non-woody biomass. He referred me to three researchers from Purdue that do research in Poplar: Rick Meilan (rmeilan@purdue.edu), Clint Chapple (chapple@purdue.edu), and Nate Moser (mosiern@purdue.edu).

Current Status: We are reaching out to Rick Meilan, Clint Chapple, and Nate Moser.
3) Identify the Market for Biomass.

**Biomass Sources Within Ten Counties Surrounding Iowa City**

The Team looked at the nine counties surrounding and including Johnson County (where Iowa City and the University of Iowa reside) to determine acreage counts. While not all of the area in the graph below is within the 50 mile radius requested by the Client, the Team is using this as a starting point to determine the land that is available to meet the Client’s needs for growing woody biomass.

<table>
<thead>
<tr>
<th>County</th>
<th>Total Acres</th>
<th>Total Crop Acres</th>
<th>Total Land in Farms</th>
<th>Other Use Land in Farms</th>
<th>Land not in Farms</th>
<th>Non-crop, Non-CRP land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johnson</td>
<td>398,943</td>
<td>226,481</td>
<td>321,139</td>
<td>94,658</td>
<td>77,804</td>
<td>50,823</td>
</tr>
<tr>
<td>Benton</td>
<td>459,808</td>
<td>316,339</td>
<td>400,934</td>
<td>84,595</td>
<td>58,874</td>
<td>54,954</td>
</tr>
<tr>
<td>Linn</td>
<td>463,709</td>
<td>261,474</td>
<td>335,378</td>
<td>73,904</td>
<td>128,331</td>
<td>45,823</td>
</tr>
<tr>
<td>Jones</td>
<td>369,087</td>
<td>230,163</td>
<td>324,003</td>
<td>93,840</td>
<td>45,084</td>
<td>57,965</td>
</tr>
<tr>
<td>Cedar</td>
<td>372,480</td>
<td>266,200</td>
<td>337,000</td>
<td>70,800</td>
<td>35,480</td>
<td>42,479</td>
</tr>
<tr>
<td>Muscatine</td>
<td>287,402</td>
<td>162,098</td>
<td>221,904</td>
<td>59,806</td>
<td>65,498</td>
<td>36,688</td>
</tr>
<tr>
<td>Louisa</td>
<td>267,520</td>
<td>145,300</td>
<td>200,100</td>
<td>54,800</td>
<td>67,420</td>
<td>37,596</td>
</tr>
<tr>
<td>Washington</td>
<td>365,292</td>
<td>211,163</td>
<td>325,836</td>
<td>114,673</td>
<td>39,456</td>
<td>53,679</td>
</tr>
<tr>
<td>Keokuk</td>
<td>371,159</td>
<td>184,688</td>
<td>318,160</td>
<td>133,472</td>
<td>52,999</td>
<td>66,711</td>
</tr>
<tr>
<td>Iowa</td>
<td>375,901</td>
<td>211,167</td>
<td>345,231</td>
<td>134,064</td>
<td>30,670</td>
<td>77,250</td>
</tr>
<tr>
<td>Totals</td>
<td>3,731,301</td>
<td>2,215,073</td>
<td>3,129,685</td>
<td>914,612</td>
<td>601,616</td>
<td>523,968</td>
</tr>
</tbody>
</table>

The two most notable points from the above acreage counts is that there is over 900,000 acres of land on farms that are not used for growing crops. While the Team is trying to analyze a further breakdown of these acreage counts, one may guess that this includes forest, ungrazed grassland, and CRP grassland. In addition, there is over 520,000 acres of land in the ten counties that are in farms that are not used for row crops or CRP. Due to the fact that the Client will need approximately 130,000 acres of land to produce woody biomass to meet its goals, the Team is optimistic that this amount of land can be found.

within the approximately 900,000 acres of non-crop farm land found within the ten counties surrounding and including Johnson County.

**Clear Creek Watershed**

In addition to researching general land use data in the ten counties surrounding and including Johnson County, the Team looked specifically at the Clear Creek Watershed as a source for woody biomass.

The Clear Creek Watershed is composed of roughly 66,000 acres in Johnson County, northwest of Coralville, Iowa. The land area contains over 300 commercial farms, 250 rural non-farm residences, as well as the communities of Tiffin, Oxford, and parts of urban Coralville. It is worth noting that while the Clear Creek Watershed may be a good source to provide woody biomass to the Client, due to the fact that the Watershed is only 66,000 acres, and the Client will need approximately 130,000 acres, that the Client will need to find additional sources of woody biomass in addition to the Watershed.

The creek is vital to both agriculture and urban settlements in the region, as it passes through farmland and empties into the Iowa River in Coralville. The city of Iowa City, surrounding communities, and the University of Iowa source drinking water downstream from Clear Creek, and thus its cleanliness and integrity is vital. Water quality has diminished in the last several decades due to runoff, contamination, and erosion, and water is high in nitrogen and phosphorus. As a result, in 1998 Clear Creek was named a priority watershed by the Water Conservation District. Targeted projects to improve the ecosystem were begun.

The Clear Creek Watershed Enhancement Project manages conservation efforts within the basin. Financial incentives are in place for landowners to protect the waterways and prevent erosion, soil contamination, and runoff. Projects typically establish vegetation buffers (including tree planting), which remove up to 50% of pesticides, 60% of other pathogens, and reduce soil erosion by 80%. Financial incentives are available to cover between 75 to 90% of the cost of such projects.

**Nearby Communities:** Conroy, Williamsburg, Tiffin, Coralville, Oxford, North Liberty, Iowa City

**Size:** 66,142 acres

**Land Use:**

- Corn: 27.81%
- Soybeans: 22.33%
- Ungrazed Grass: 22.79%
- Deciduous Forest: 7.83%
- CRP Grassland: 5.24%
- Roads: 3.31%
- Grazed Grass: 3.26%
- Alfalfa: 2.84%
- Commercial/Industrial: 1.64%
- Residential: 1.17%
- Barren: 0.35%
- Wetland: 0.25%
- Other Rowcrops: 0.24%
- Wetland Forest: 0.15%
- Coniferous Forest: 0.13%
- Water: 0.0%

**Feasibility of Sourcing Biomass in Clear Creek**

The Clear Creek watershed is a strong candidate location to source woody biomass for the University of Iowa. Most of the land is within 20 miles of Iowa City, and resident farmers tend to be familiar with the University and the Iowa City community. Roughly 23% of the land, over 15,000 acres, is ungrazed grassland that could potentially be converted for farming poplar, cottonwood, or ash trees. An

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5 Clear Creek Enhancement Project data
additional 8% is deciduous forest, which could be targeted for forestry management wood sourcing. Corn and soy constitute about 50% of the watershed.

Current conservation programs and financial incentives may provide unique opportunities for biomass sourcing. Riparian buffers, including trees, are eligible for 90% cost sharing. Farmers willing to plant trees on fallow land or ungrazed grassland may be eligible to receive such funding. However, the Team has not determined if farmers would be able to harvest these trees if they were eligible for funding.

The Amana Society (Society) owns thousands of acres of land in the Clear Creek watershed, and is the largest single landowner in Iowa. Land owned by the Society is used for different purposes, including farming, forestry, tourism and recreation, and fallow fields. The Society maintains a professional staff to manage lands, including a forester. Land currently under CRP or Wetland Reserve Program contracts may also be sources. Owners of such land may be able to plant trees during their contract period, which typically last 5 to 10 years, and harvest the trees once the contracts expire.

Contact: James Martin, Watershed Coordinator
(319) 337-2322; James.Martin@ia.nacdnet.net

Map of Clear Creek Watershed

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6 Iowa Department of Natural Resources
**Alternative Waste Stream Sources of Biomass**

Below is some information on alternative sources of biomass. At the beginning of the project, the Team conducted this research to help identify biomass sources to help with the University of Iowa’s 2020 Sustainability Targets. However, after discussion with the Client, the Team spent its energy researching best practices and starting to identify a market for woody biomass. The team did not want its efforts to be lost from researching alternative sources of biomass, so you will find our initial efforts and contacts below, if the Client wishes to pursue these alternatives.

**Landfill**

Currently all wood that arrives at the landfill is diverted, chipped, and put into a pile. It is then freely available for residents for personal use. The contact for the Iowa City landfill is Jennifer Jordan.

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7 Iowa Geographic Map Server, Iowa State University Geographic Information Systems Support & Research Facility
Jennifer Jordan  
Recycling Coordinator  
(319) 887-6160

Local Tree Services  
The Team contacted the Total Tree Care of Iowa City and talked to the owner, Seth Bihun. Seth described the process by which his company disposes of the trees and limbs they remove for customers. When trees or limbs are removed, they are chipped on site. They are then taken to the landfill or occasionally provided to individuals for gardening or landscaping purposes.

The company is busiest during the summer and produces 6 to 8 truckloads per week. Each company truck holds 10-12 tons, so during the summer months the company produces up to 60 to 80 tons of wood chips per week. Seth seemed very interested in providing biomass to the University of Iowa. Presently, most of the chips are not used purposefully and Seth expressed a desire to change this. For instance, he had considered shipping chips to a wood-burning power plant near Cresco, Iowa.

Seth Bihun  
Total Tree Care of Iowa City  
(319) 430-3590

Sawmills  
The Team contacted Randy Woodroffe, the owner of Woodroffe Sawmill in Fort Madison, Iowa. The sawmill purchases local timber to make pallets. Sawdust is sold for animal bedding and wood shavings and chips is sold for landscaping for $20 per ton.

Industrial Wood Waste  
The Team contacted HNI industries in Muscatine, Iowa to determine the availability of waste from furniture manufacturing. We have no information yet, but will follow up with this lead in the near future.

4) Reach out to Contacts within each Market.

Collaboration with Consumers Cooperative (Coralville, IA)  
The team held a conference call with Gary Swenka, the president of the Consumers Cooperative in Coralville, Iowa on Wednesday March 2, 2011. Topics of inquiry included farmer reaction to the proposed plan, available land, potential business structures, and ulterior concerns. Gary reacted positively to the plan, and was confident that there would be interest among constituent farmers.

Availability of Land  
Land use in Iowa tends to be very efficient, so little unused land exists. Undeveloped land is typically used for either row crops, cow pastures, or CRP contracts. Marginal land in flood plains as well as fence and ditch lines may be the best candidates for biomass sourcing. In addition, individual farmers tend to have at least three or more acres of forested land available for thinning or timber stand improvement (TSI). Due to restrictions in place, CRP land is not feasible for growing and harvesting biomass. Farmers would be willing to allow their forested or marginal land be used for biomass sourcing. Prime crop land would be off limits, however, as farmers can currently derive between $1000 and $1300 per acre in revenue from corn and soy.
Suggested Business Structure
A private entity, either via a business or new cooperative, will be needed to manage harvesting, chipping, storage, and transportation. Few existing cooperatives have the proper machinery to harvest trees or conduct forestry management, and if equipment were purchased by the University to be rented to cooperatives, it would not be properly treated and maintained. Therefore, machinery will need to be purchased and maintained privately, and there must be a labor force dedicated to the operation. Various private loggers exist in eastern Iowa, such as Wood Products of Iowa. It is recommended that chipping be done on site to ease transportation. Storage must be done proximate to the power plant, which will likely require construction of a new facility by the university.

Contacts
Gary Swenka, President of Consumers Cooperative (Coralville, IA)
(319) 545-2012, gswenka@southslope.net

Keith Nuezil, Wood Products of Iowa
(319) 331-6362

Tim Thompson, Iowa Department of Natural Resources
(319) 354-1074

Collaboration with Regional Partners in Amana
Lands located in the Clear Creek watershed within 50 miles of the University of Iowa are ideal for biomass sourcing. To this end, the team networked with local and regional stakeholders to investigate interest in the project, availability of lands, feasibility of sourcing wood chips, logistics and supply chains, and suitable business models.

A meeting was held on Friday March 4, 2011 in Amana, Iowa at the offices of the Iowa Valley Resource, Conservation and Development (IVRC&D). Representatives from Amana Farms Inc., IVRC&D, USDA Natural Resources Conservation Service (NRCS), and the University of Iowa attended. Contacts are below.

Tanya Meyer-Dideriksen, Iowa Valley RC&D Coordinator,
Tanya.Meyer@ia.usda.gov, (319) 622-3264

Larry Gnewikow, Amana Forestry, Amana Farms Inc.
amforest@amanas.net, (319) 622-7554

Peter Hoehnle, Iowa Valley RC&D
peter@ivrcd.org, (319) 622-3264

Steve Johnston, USDA NRCS
(319) 668-2359

There was strong interest among all attendees in any initiative to source biomass for energy generation. The concept is not new and various initiatives have been attempted successfully in Iowa in the past. Below is a discussion of specific outcomes and knowledge from the meeting.
Availability of Land for New Growth, Forestry Management, and Marginal Harvesting
The majority of land in the region is privately owned and either farmed with row crops, used for livestock pastures, or under CRP contract. Establishing new land for tree growth or diverting land from row crops for this purpose is not feasible. The significant switching costs notwithstanding, corn and soy commodity prices are high so traditional row crops are likely to be more profitable than biomass for the foreseeable future (corn is currently $7 per bushel). Encouraging farmers to switch from row crops to tree growth is not recommended.

Roughly 20,000 acres of land is currently under CRP contract within the region. As crop prices rise, rental rates have not kept pace with the profitability of farming. As such, land coming out of CRP contracts is often converted immediately to row crops. Without a proven business model, it is unlikely that owners of released CRP land could be encouraged to grow trees for biomass.

There is at least 10,000 acres of marginal land within the region that may be unsuitable for farming. This figure is an estimate and mostly includes land in flood plains or river bottoms and is typically in places where farming has been attempted unsuccessfully. This land is the best opportunity for biomass sourcing either through new growth or forestry management. Fallow land in flood plains will sustain certain species of trees better than row crops, and existing forested land can be harvested or thinned with ‘timber stand improvement’ (TSI).

Amana Farms Inc. has experience managing its own forests and growing new biomass. They have great interest in this initiative. Amana currently produces about 300 tons of firewood through forestry management annually, though it is likely that this quantity is substantially below the potential of their operation. Uncut, unsorted logs are currently sold for $16 per ton. Amana Farms Inc. is also in possession of river bottom land that has previously been used for new growth of biomass.

Harvesting, Processing, and Supply Chain
The entire supply chain, from harvesting to endpoint delivery will have to be closely managed by the University or a private designee. Neither land owners nor existing cooperatives have the proper equipment to harvest new growth or conduct forestry management. Furthermore, land owners would be unlikely to buy shares in a new biomass cooperative if profitability is unproven. Although farmers may be interested in growing biomass on marginal land or allowing management of forested acres they own, they would be unlikely to do the harvesting, chipping, or transport themselves.

Appropriate Business Structure
The University will need to either manage the harvesting, chipping, and transport or hire a private entity or cooperative to do so. The University may choose to hire various partners with the proper equipment and expertise to extract timber from forests, harvest new growth, chip wood, store chips in an intermediate point, and deliver a steady stream of chips to the power plant.

Strategy
- Continue building a relationship with Amana Farms Inc. and investigate specific forested and river bottom land for sourcing.
- Conduct a GIS survey to identify flood plain or river bottom land proximate to the University. Working through the IVRC&D and USDA NRCS, approach landowners to discuss the opportunity.
- Investigate companies with the ability to harvest, chip, store, and transport biomass. This could be done though and RPF of existing companies or establishing a new entity.
Farmer Outreach
The Team believes that farmer outreach will be a significant part of the upcoming steps of the project, and that this can be done in two ways: reaching out to farmers through existing Farmer Cooperatives, and also reaching out to land owners directly through a direct mail. While we have mentioned reaching out through Farmers Cooperatives above, the team also believes that the Client can obtain a mailing database of land owners within the ten-county area, and reach out to them directly through a mailing. While the Team realizes that a mass-mailing is not a sustainable practice, we feel that a one-time mailing to reach out to future suppliers, who would then be able to provide a sustainable source of fuel, would be worth it.

Two possible resources to purchase this mailing would be the following:

1) County assessors office (www.iowaassessors.com). Through this website, the Client would be able to reach out to each county assessor (unfortunately, the Client will have to go to all ten county assessors, there is no one-stop shop for this), and request the land owner data. The Client may not be able to get data indicating the quality of land and the suitability for growing trees; however, they may be able to request data such as ‘addresses for all land owners in Johnson County who own more than 5 acres of land.’

2) Plat book publishers (www.farmandhomepublishers.com, (641) 444-3508). Due to the fact that the plat book publishers are a business, they may have the farmer land and mailing data available for purchase as well.

5) Create a Business Model.

As stated above, the Team met with the Entrepreneurial Center at the University of Iowa to create a contact and help identify the best business model for the University in continuing this project. The Team met with Lee Groeschl, the Associate Director of Business Services (lee-groeschl@uiowa.edu; (319) 335-0959). After the conversation with Lee, the Team determined that there are four different scenarios about how to build this business model:

a) Add a new state employee staff under Facilities Management to manage this project
b) Create a non-profit with input from the University
c) Create a private company/LLC
d) Utilize a current harvester (private wood chip company) to expand and handle all relations between the suppliers and the University

Once the University continues with the project, it will be able to determine, possibly working with Lee, as to which of the business entities are the best to handle all of the logistics.
Conclusions and Next Steps
The overall project to supply the University of Iowa with a reliable, sustainable source of biomass for fuel is well on its way. The Team was able to make contacts with several organizations and individuals who are the suppliers, regulators, and customers in this project.

The Team believes that the Client will be able to find the 100,000 tons of woody biomass that it will need to make the 2020 Sustainability Goals. However, the team also believes that the Client will need to look at a diversified strategy to get this wood. With current corn prices as high as they are, farmers will be using all available land for crop production. However, here are some numbers with possible woody biomass yields:

- If 10% of non-crop, non-CRP land is used, would be up to 150,000 tons of woody biomass
- If 10% of Clear Creek Basin is used (currently over 20% is ungrazed grassland): 20,000 tons
- If 500 acres forestry management per year: 15,000 tons (best practices indicated that 30 tons of woody biomass per acre of forested land can be harvested every 25 years)
- If the 10,000 acres of flood plain land are used: 30,000 tons every year
- Other waste stream: 80,000 tons/year of cardboard waste

As you can see, there is the possibility that this biomass is available in the area. However, the University will need to continue with reaching out to the various suppliers to have this wood available.

Regarding next steps, the Client will need to continue to deepen the relationships with the suppliers and regulators, to determine how much of a supply is out there. Per the project lifecycle above, the Client should do the following steps:

4. **Reach out to contacts within each market.**
   Continue to work with contacts at Amana Farms, Clear Creek Basin, and local Farmers Cooperatives. In addition, purchase a land owner database so that a mailing can be sent out to all land owners to gauge interest. Finally, keep in contact with Dr. Richard Hall from Iowa State University, due to his deep knowledge in this subject.

5. **Create a business model.**
   Work with the Entrepreneurial Center at the University of Iowa to determine which is the best business model to carry out the project. If the University chooses to approach current private businesses, several are named in the contact list below.

6. **Solve project logistics.**
   Once the business model is created, work with that business entity to solve the project logistics, including harvesting, storage, and transportation.

7. **Create boundaries within which to produce fuel.**
   Work with the Office of Sustainability to determine the boundaries within which this fuel will be produced (for example, no clear-cutting of forests, or no old-growth forests).

8. **Sign up fuel producers into contracts.**
   Once the logistics and business model are created, sign up local suppliers.
## Contact List

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Email/Website</th>
<th>Phone</th>
<th>Contacted by Biomass team?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steve Pieper</td>
<td>Sales Representative</td>
<td>Roto Chopper</td>
<td><a href="mailto:spieper@rotochopper.com">spieper@rotochopper.com</a></td>
<td>(608) 486-2851</td>
<td>No</td>
</tr>
<tr>
<td>Dr. Hank Stelzer</td>
<td>State Forestry Specialist</td>
<td>University of Missouri</td>
<td><a href="mailto:stelzerh@missouri.edu">stelzerh@missouri.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Greg Coffin</td>
<td>Power Plant Superintendent</td>
<td>University of Missouri</td>
<td><a href="mailto:coffing@missouri.edu">coffing@missouri.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Dr. Richard Hall</td>
<td>Author and Biomass Expert</td>
<td>Iowa State University</td>
<td><a href="mailto:rbhall@iastate.edu">rbhall@iastate.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Dr. Maureen McCann</td>
<td>Energy Research Center</td>
<td>Purdue University</td>
<td><a href="mailto:mmccann@purdue.edu">mmccann@purdue.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Dr. Nick Carpita</td>
<td>Professor, Botany and Plant Pathology</td>
<td>Purdue University</td>
<td><a href="mailto:carpita@purdue.edu">carpita@purdue.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Rick Meilan</td>
<td>Researchers of Poplar Tree</td>
<td>Purdue University</td>
<td><a href="mailto:rmeilan@purdue.edu">rmeilan@purdue.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Clint Chapple</td>
<td>Researchers of Poplar Tree</td>
<td>Purdue University</td>
<td><a href="mailto:chapple@purdue.edu">chapple@purdue.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Nate Moser</td>
<td>Researchers of Poplar Tree</td>
<td>Purdue University</td>
<td><a href="mailto:mosiern@purdue.edu">mosiern@purdue.edu</a></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>James Martin</td>
<td>Watershed Coordinator</td>
<td>Clear Creek Basin</td>
<td><a href="mailto:James.Martin@ia.nacdnet.net">James.Martin@ia.nacdnet.net</a></td>
<td>(319) 337-2322</td>
<td>Yes</td>
</tr>
<tr>
<td>Jennifer Jordan</td>
<td>Recycling Coordinator</td>
<td>City of Iowa City</td>
<td><a href="mailto:James.Martin@ia.nacdnet.net">James.Martin@ia.nacdnet.net</a></td>
<td>(319) 887-6160</td>
<td>Yes</td>
</tr>
<tr>
<td>Seth Bihun</td>
<td>Owner</td>
<td>Total Tree Care Iowa City</td>
<td><a href="mailto:amforest@amanas.net">amforest@amanas.net</a></td>
<td>(319) 430-3590</td>
<td>Yes</td>
</tr>
<tr>
<td>Gary Swenka</td>
<td>President</td>
<td>Consumers Cooperative</td>
<td><a href="mailto:gswenka@southslope.net">gswenka@southslope.net</a></td>
<td>(319) 545-2012</td>
<td>Yes</td>
</tr>
<tr>
<td>Keith Nuezil</td>
<td>Owner</td>
<td>Wood Products of Iowa</td>
<td></td>
<td>(319) 331-6362</td>
<td>No</td>
</tr>
<tr>
<td>Tim Thompson</td>
<td></td>
<td>Iowa DNR</td>
<td></td>
<td>(319) 354-1074</td>
<td>No</td>
</tr>
<tr>
<td>Tanya Meyer-Dideriksen</td>
<td>Coordinator</td>
<td>Iowa Valley RC&amp;D</td>
<td><a href="mailto:Tanya.Meyer@ia.usda.gov">Tanya.Meyer@ia.usda.gov</a></td>
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<td>Amana Farms Inc.</td>
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<td>Steve Johnston</td>
<td></td>
<td>USDA NRCS</td>
<td></td>
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<td><a href="http://www.farmandhomepublishers.com">www.farmandhomepublishers.com</a></td>
<td>(641) 444-3508</td>
<td>No</td>
</tr>
<tr>
<td>Lee Groeschl</td>
<td>Associate Director of Business Services</td>
<td>U of I Entrepreneurial Center</td>
<td><a href="mailto:lee-groeschl@uiowa.edu">lee-groeschl@uiowa.edu</a></td>
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