DRAFT

Herbaceous Crops (Perennials 2) Working Group Session Summary
30x30 Workshop
August 1 – 2, 2006

Day One: August 1, 2006

Day One Participants:

Steve Thomas	Steve Long	Sara Bergan	Nick Nagle
Richard Hess	James Zhang	David Bransby	Terry Nipp
Bill Belden	Tom Foust	Bob Perlack	James Wade
Kevin Kephart	Oliver Peoples	Bob Wooley	John Malloy
John Ferrell	Sharlene Weatherwax		Mark Paster
Ken Vogel	Melissa Klembara		

1. Questions on Agenda/Scope of Session

Ken Vogel: Can it be assumed that the group will accept the assumptions in the Billion Ton Study up front, prior to discussion?
John Ferrell**:** This should be open to discuss within the group. Several feel that the Billion Ton Study is too conservative.

Terry Nipp: Is this effort being coordinated with the Roadmapping effort underway by the Biomass R&D Technical Advisory Committee?
John Ferrell: Yes; some members involved in that effort are here today. There will be a report on this meeting at the next Committee meeting.

Steve Long: Will the reality of land availability be addressed during the session? Will the adoption of perennial herbaceous crops by farmers be addressed?
John Ferrell: Yes; it is up to session participants what to decide are issues, and what will be addressed.

2. 2012 Cost Target Discussion

Questions Posed to Group: How do you define cost competitive for cellulosic ethanol? What fuel is the pathway competing with? When do you see fuel from this pathway entering the market?

Method: Each participant was asked to write his/her answer on an index card. All of the answers were stated aloud, posted, and recorded. There was little further discussion. The group was not asked to come to consensus on these questions.

See "Cost Targets" tab in attached spreadsheet for index card responses.

Summary: The group saw cellulosic ethanol as competing with a variety of fuels including gasoline, starch-based ethanol, animal waste or liquids from coal. The majority

of responses indicated gasoline. A variety of estimates of cost competitiveness were listed but many respondents indicated that it was difficult to identify a specific cost target. Market entry estimates ranged from five to 15 years.

Discussion Responses:

- Steve Thomas: Cellulosic ethanol must be cost competitive with gasoline in the market place. By 2012 there should be some conversion facilities using herbaceous crops.

- Steve Long: Cellulosic ethanol must be cost competitive with petroleum. In order for it to become competitive, we must take the environmental benefits of cellulosic ethanol into account versus petroleum. 2018 is a more realistic target for cellulosic ethanol to become cost competitive.

- James Zhang: Dollar earned per acre must be beneficial to the farmer before cellulosic ethanol will become cost competitive. Cellulosic ethanol is competing with fossil fuels. Cellulosic ethanol will be available in the market relatively soon; 2012 is a good estimate.

- Nick Nagle: Cellulosic ethanol must be cost competitive with gasoline and starch-based ethanol. 2015 is a good target for herbaceous crops to be utilized in a full scale plant; by 2012 a pilot plant will be possible.

- John Malloy: $1.50 per gallon cellulosic ethanol will be cost competitive. There is an opportunity to drive cellulosic ethanol forward in the marketplace with next year's Farm Bill and other incentives. Cellulosic ethanol must compete with agricultural residues and wood. It should enter the market by 2008 – 2009.

- Mark Paster: The cost of cellulosic ethanol must be equivalent to $1/mile driven by the consumer (including the vehicle) to be cost competitive. The price will depend on several factors including policy. Cellulosic ethanol is competing with all other vehicle options. It should be in the marketplace by 2015.

- Ken Vogel: Gasoline and crude oil are the main competitors. Cellulosic ethanol could enter the market in 2010.

- Tom Foust: The $1.07 cost target is based on Btu adjusted ethanol compared to gasoline, or the cost for the consumer to drive. Cellulosic ethanol must compete with gasoline and starch-based ethanol. Cellulosic ethanol from herbaceous crops will enter the market in 2015 – 2020; from ag residues will enter first.

- David Bransby: Cellulosic ethanol needs to be cost competitive with gasoline. It will enter the market in 2015, with the first pilots being built in 2012.

- Bob Wooley: Early on, between now and 2020, cellulosic ethanol will need to compete with corn ethanol. In the longer term, it will need to compete with gasoline.

- Richard Hess: We need to assume multiple crops. Cellulosic ethanol will be cost competitive with immediately available biomass (i.e. crop residues) in the near term. It will first be used to enable stranded feedstocks (i.e. corn stover is only available in the mid-west) by supplementing where they are unavailable. In the long-term, herbaceous crops must compete with land resources.

- James Wade: Cellulosic ethanol will be cost competitive when it can be bought and sold in the market, and when it can compete with land resources. This is a regional question. It must compete with grain alcohol and gasoline. It should be in the market around 2015.

- Terry Nipp: Cellulosic ethanol will not be cost competitive with gasoline in the near-term; if it can make a profit investments will be made (this may require incentives). It competes with food crops and other land uses.

- Kevin Kephart: The price of oil drives the liquid fuel system. Cellulosic ethanol needs to be profitable to the producer. It competes with other biomass resources (i.e. ag residues), not other fuels, and other uses for the same resources (i.e. land conservation, to grow other feedstocks). It will cost competitive early in the next decade.

- Bob Perlack: Cellulosic ethanol is subject to regional competitiveness with conventional fuels. There is also an infrastructure issue. It competes with gasoline; characteristics of fuels must be taken into consideration. It should be available in the market by 2012 – 2015.

- Oliver Peoples: The real competition for cellulosic ethanol is Brazilian sugar cane and corn ethanol. It should be cost competitive by 2010. Ethanol should not be the only biofuel considered.

- Sara Bergan: Cellulosic ethanol is competing in the long-term with oil/petroleum and coal to liquids. To be competitive, it must also have a farm gate price that is advantageous to the farmer. Herbaceous crops must compete with ag residues. It should enter the market within 3 – 5 years.

- Bill Belden: The regional base for competing land uses is the main competition for herbaceous crops. We need new producers and/or a shift in landowners to reach the target.

3. Identification of Priority Pathway Routes

Question Posed to Group: What pathway routes offer the greatest potential for commercial success for herbaceous crops? Include the feedstock and the resulting biofuel(s).

Method: Group was divided into smaller working groups, and each was given a poster-sized pathway diagram (see Figure 1). The groups were asked to review the stages of the pathway (i.e. feedstock production, conversion processes, outputs, etc.) and to identify the route that was most likely to lead to commercial success. Groups were told that they could rearrange the stages of the pathway, delete or add stages of the pathway, or to draw an entirely new pathway.

Each group presented its results to the group as a whole. The group reviewed all of the results and agreed upon a couple major changes that would need to occur to the pathway diagram. With these changes incorporated, discussion for the remainder of the workshop centered on the modified pathway stages (see Figure 2).

Move pathway diagram here

Small Working Groups:

"Green Group":

James Wade	Kevin Kephart	John Malloy
Oliver Peoples	Bob Wooley	

"Blue Group":

James Zhang	David Bransby	Terry Nipp
Bill Belden	Tom Foust	Bob Perlack

"Red Group":

Steve Thomas	Steve Long	Sara Bergan
Nick Nagle	Richard Hess	

Summary: The participants each identified slight changes to the pathway diagram. Each small group identified a different priority output for the pathway: heat and power, value-added products; and ??????. Most agreed that box 5.1 should be broken into more detail. There were no significant changes to the pathway flow. For purposes of discussion the pathway shown in Figure 2 was used.

Green Group Results:

- Kevin Kephart presented on behalf of the group.
- The group believed that the pathway could jump from box 5.1 to box 5.10 with the addition of natural gas as thermal input into the biorefinery added to 5.10. The group agreed that this addition was doable immediately, and that is would create demand for herbaceous feedstocks.

- The group agreed with boxes 5.1 – 5.4 of the existing pathway diagram, but thought that R&D to develop higher-value added products should be added after 5.4. This is considered an enabling technology, and applies to the enzymatic conversion process.

- The group stated that conversion is too capital intensive; feedstocks should be liquefied for transport prior to conversion.

Blue Group Results:

- David Bransby presented on behalf of the group.

- The harvest, production, and storage of the feedstock can be on its own or mixed with other feedstocks, such as wood.

- When using homogeneous feedstock, the biochemical route to mixed sugars and/or products is best. With mixed feedstocks, the thermochemical platform to syngas then to biofuels and/or other products is more flexible. The group noted that they are trying to make choices between the two with incomplete information.

- One problem that may make working with mixed feedstocks more difficult is that herbaceous crops can be delivered dry, whereas wood cannot. James Zhang pointed out that, additionally, some refineries may demand a uniform feedstock. David Bransby stated this problem can be overcome by matching the refinery with the feedstock, or the feedstock with the refinery. Tom Foust noted that a biorefinery that demands a homogeneous feedstock will have to pay for it.

- James Zhang said that products other than ethanol should be considered, such as propendiol.

Red Group Results:

- Steve Thomas presented on behalf of the group.

- The group agreed that is difficult to eliminate either the biochemical or thermochemical route from the pathway.

- The entire working group agreed that the first box (5.1) should be expanded into multiple separate boxes: storage, preprocessing, transportation, and handling.

Open Discussion on Reaching a Consensus Pathway Route(s):

- John Ferrell: Realistically, we are looking at multiple pathways?

- James Zhang: Have long term studies on removal of biomass been conducted year after year?

- Ken Vogel: We have data since about 1998 (~10 years).

- David Bransby: Ash from refineries can be placed back on the field (when thermochemical conversion is used). You can burn lignin for ash in a biochemical refinery.

- Bill Belden: We went back in with nitrogen fertilizer. P&K leech back into the soil. We need more work on this on the agronomy side.

- Oliver Peoples: There's a good model in sugar cane; they've been spreading ash for years.

- Steve Long: We take a winter harvest to maintain soil; we've had to add P&K but never nitrogen.
- John Ferrell: A regional approach makes sense here.

- Terry Nipp: The region will determine the best route.

- Ken Vogel: $1.07 assumes what feedstock cost?

- Richard Hess: $35/ton delivered. This is an interim price (to 2012); we will have to get it lower for 2030.
- Oliver Peoples: Before we focus on feedstock production we need breeding.

Figure 1: Original Pathway Diagram

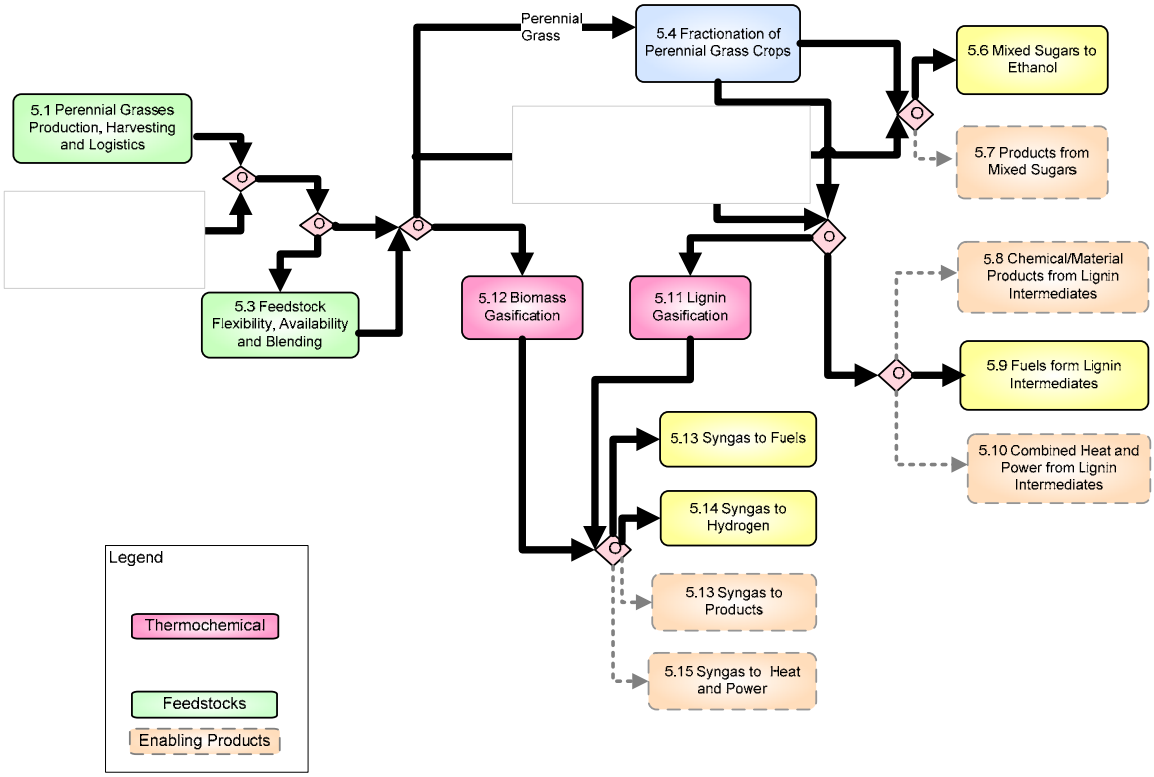

Figure 2: Revised, Consensus, Priority Pathway Used for Remainder of Workshop

Genetics → Agronomic Systems → Feedstock Production → Harvesting/Handling → Storage → Transport → Blending → Cross Cutting → Conversion (Biochemical & Thermochemical) → Mixed Sugars

→ Value-Added Products

→ Syngas

→ Heat & Power

4. Identification of Synergies and Conflicts with Other Pathways

Questions Posed to Group: What are the synergies with other breakout session pathways that we need to capitalize on to be successful? What are the potential conflicts with other breakout session pathways?

Method: The working group broke out of the smaller working groups used for the last session. Anyone with answers to the above questions responded, and was asked to place their response on an index card. Those cards were posted within the structure of the newly defined pathway (Figure 2) when appropriate.

See "Pathway Synergies and Barriers" tab on the attached spreadsheet for index card responses.

Summary: The group indicated that there are a number of synergies with other biomass feedstock pathways. Herbaceous crops should be able to utilized genomics research, feedstock collection systems, and storage systems.

Responses:

- Nick Nagle: Synergy with ag residue pathway in terms of collection, storage, and conversion; capital is all the same.
- Ken Vogel: Distiller's grains.
- David Bransby: Synergy with the woody and forest pathways in terms of mixing the feedstock (i.e. herbaceous crops for 6 months, woody or forest crops for 6 months).
- Kevin Kephart: Lignin from this pathway supports the corn pathway.
- Terry Nipp: There is an overlap across all pathways in relation to genomics.
- Nick Nagle: There is an overlap in all pathways regarding infrastructure.
- David Bransby: In the near term, ag residues are going to be cheaper, so they will conflict with the herbaceous pathway.
- Ken Vogel: I disagree; each feedstock will compete.
- Oliver Peoples: There is no farm support policy in this area [support for herbaceous crops].
- ?: Wet versus dry herbaceous systems.

5. Identification of Barriers for Priority Route (Figure 2)

Question Posed to the Group: What are the barriers facing this route?

Method: Each participant was asked to write his/her answers on an index card. Each response was read aloud, and posted on the wall under the appropriate stage of the priority pathway (Figure 2). After all responses were posted, duplicates were removed. A period of open discussion was held to add barriers and provide more context on barriers. To prioritize barriers, each participant was given 7 dots, and asked to place one dot on each barrier they identified as a priority (multiple dots could not be placed on one barrier by the same person). Priority barriers were presented in the first day's closing presentation.

See “Pathway Synergies and Barriers” tab on the attached spreadsheet for index card responses, organized by priority votes.

Summary: Many barriers specific to herbaceous crops were related to plant genetics, feedstock production, and agronomic systems. The group identified an important need for breeding and genetics research and the lack of see supply. Also, removal of barriers found in the Farm Bill was identified as a high priority as were the need to reduce risk to producers and potential investors.

Responses:

- Oliver Peoples: All of these fall under genetics: trans gene containment; advanced breeding technology; and conversion process modifications.
- Kevin Kephart: How industry captures values.
- Sara Bergan: There is no farm support for herbaceous crops. Under transportation, densification is an issue. Under genetics, there is a need for advanced work beyond switchgrass.
- James Wade: Competition for land resources.
- Richard Hess: Under breeding, trait delivery platforms, sterility systems/domestication – it all relates to risk management.
- Bob Wooley: Under genetics, ease of processing.
- Tom Foust: Need to look at feedstock as a dual use crop (i.e. animal feed and fuel, etc.).
- Bob Perlack: Limited harvest windows for herbaceous crops. Lack of information on the production of herbaceous crops. Limited knowledge of production systems. Harvesting systems for different types of feedstocks.
- David Bransby: Lack of seed. Route of establishment; there should be a role for annuals. Engineering and construction services for conversion plants. Dispute between lowering feedstock cost or increasing conversion efficiency.
- Terry Nipp: Under feedstock production, the Farm Bill policy. Cost of transport.
- Bill Belden: Bale density; ag equipment; and tech fees from seed companies as a pass through.
- Ken Vogel: Lack of production information by region (25 mile radius) for companies looking to invest. Entomology problem: there are no plant scientists working on cellulosic feedstocks. Over-supply of protein.

- John Malloy: Feedstock cost and availability. Fair return to the farmer. Timeline to ramp-up production. Lack of incentives.

- Nick Nagle: Ecological constraints: a lack of seed equals a lack of diversity; loss of habitat. We need a policy development for herbaceous crops (i.e. farm co-ops, partnerships, etc.). Mixed sugars: demonstrate full integration of the ethanol process (i.e. robust C5 organisms).

- James Zhang: Lack of knowledge; there is a focus on switchgrass, but there are other higher yield herbaceous crops. Deregulation problem: GMOs, new species, and non-native species should be deregulated. Storage delivery systems. Pretreatment costs.

- Steve Long: There is a lack of knowledge on yields of crops. There is a lack of comparison of switchgrass cultivars with other feedstocks. There are limited transformation systems. Storage of adequate quantities of biomass is an issue. Land for herbaceous crops conflicts with other land uses (i.e. the 5.5 million acres figure in the Billion Ton Study).

- Steve Thomas: There is a need for the integration of an energy crop system into the existing system. There are a number of transportation issues around infrastructure (i.e. roads). Feedstock yield/acre and quality. There is a lack of coordination of ag opportunities with process opportunities at the same site at the same time.

- James Wade: Managing producer risk. Education of potential funders.

- Bill Belden: Processing technology.

- Sara Bergan: Synergy/conflict of perennial production using existing policies.

- John Malloy: Lack of funding for demonstration plants.

Day Two: August 2, 2006

Day Two Participants:

Steve Thomas	Steve Long	Sara Bergan	Maurice Hladik
Nick Nagle	Richard Hess	James Zhang	David Bransby
Terry Nipp	Bill Belden	Tom Foust	Bob Perlack
James Wade	Kevin Kephart	Oliver Peoples	Bob Wooley
John Ferrell	Sharlene Weatherwax		Ken Vogel
Melissa Klembara			

6. Development of Timeline

Question Posed to the Group: What is the timeline for pilot, demonstration, and commercial plants for this route?

Method: There was open discussion about what information was required before this question could be answered. At the end of discussion, it was decided by the group that the best way to set a timeline was to set 3 separate timelines focused on land type: CRP land, pastureland, and cropland. The group divided into 3 groups, one for each land type. Individuals decided in which group they best fit. Each group developed their own timeline on a flip chart, then reported to the entire group.

Discussion on Question:

- Steve Thomas: We need a volumetric goal first.
- Melissa Klembara: Volumetric potential is included in the pathway description.
- John Ferrell: Part of the answer to this question should be what policy will support this timeline, what R&D will need to be funded.
- Maurice Hladik: We need to get started right away in order to achieve long-term goals.
- Bill Belden: Regarding CRP acres, farmers sign 5 – 10 year contracts; we need to establish a base by 2010 (~10%), and reach 80% by 2020.
- Bob Perlack: The 55 million acres estimated for herbaceous crops in the Billion Ton Study includes the following: 20 million acres active cropland, 20 million acres pastureland, and 15 million acres CRP land.
- John Ferrell: Other forces will counter CRP usage.
- Terry Nipp: CRP, pastureland, and cropland need to be addressed separately.
- Maurice Hladik: USDA thinks that energy crops can be rolled into emergency storage. At least three major environmental groups (Ducks Unlimited, NRDC, and ?) agree that CRP land should grow switchgrass rather than row crops.
- Terry Nipp: For the other two land uses, cropland and pastureland, what is the timeline to ramp up to the required level of production?
- Bill Belden: The 2007 Farm Bill will set the stage for that.
- Ken Vogel: In the Midwest, it is difficult to shift pastureland to CRP land.

- David Bransby: There are several difficulties associated with pastureland; crop producers and ranchers have a different economic outlook – ranchers are less inclined to switch to switchgrass.

- John Ferrell: The Billion Ton Study identifies CRP, cropland, and pastureland. CRP probably will not grow very much; pastureland is probably difficult; of the 3, which has the potential to grow the most?

- David Bransby: In the southeast, cropland.

- Ken Vogel: In the Midwest, CRP and cropland.

- Kevin Kephart: Must a feedstock production program be limited to CRP?

- John Ferrell: We should focus on all 3 land types and try to develop a timeline.

- Steve Long: In all 3 cases, it will depend on profitability for the farmer.

- Oliver Peoples: Farmers face other costs that are subtracted from cost per crop.

- Bob Perlack: Land must come from all 3 categories because we are constrained by requirements for food, feed, and exports. If these demands change, changes in acreage available will also occur. The Farm Bill is important to this. Yields will vary by type of land.

- Ken Vogel: We're not going to reach the goals unless there are major changes in the CRP program.

<u>Pastureland Results:</u>

- Steve Thomas reported the group's results. The group was unable to establish a specific timeline.

- Only about 10% of the total U.S. pastureland would actually be available for herbaceous crop production. This equates to about 7 million acres.

- Herbaceous crop production would need to compete with cattle ranching economically.

- There are no policy constraints.

- Pastureland is of poorer quality than cropland.

- Pastureland is subject to regional variability.

- Cattle ranching is a lifestyle; it would require cultural changes unlike the other land types.
- We tried to stay away from subsidies, but they would make a difference.

Cropland Results & Discussion:

- Bill Belden reported the group's results.
- Within the next 90 days: Impact 2007 Farm Bill
- 2010: Ramp-up R&D to prove economic feasibility
- 2014: Assuming a 7 year Farm Bill, change policy to help meet future needs
- 2020: Need 85% acreage committed
- 2020 – 2030: R&D requirements in genetics, production techniques, yield & modeling, handling & processing
- Oliver Peoples: Some geographical issues apply to this area as well.
- David Bransby: In the south, we're competing with cotton; economics would have to shift to energy crops pretty quickly.
- Bill Belden: We need to get USDA more heavily involved immediately.
- Steve Long: Experiment stations need to get involved too.

CRP Results & Discussion:

- Maurice Hladik reported the group's results.
- 2007: Farm Bill revisions to authorize 3 million acres to go to dedicated energy crops, plus education programs for farmers.
- 2010: Designated land strategically and environmentally selected.
- 2014: Next Farm Bill should authorize 15 million acres to dedicated energy crops.
- 2020: Total 15 million acres should be in production. This will equal 60 80 million gallon biorefineries.
- 2030: 80 80 million gallon biorefineries.
- John Ferrell: Is an alternative program needed (i.e. a biomass reserve program)?

- Bill Belden: Politically, how are you going to determine the 3 million acres?

- Maurice Hladik: It is a tough political choice, and we did not discuss it too much.

- James Wade: There was no discussion about markets. Crops and the biorefinery need to be coordinated as far as when they are available.

7. Identification of R&D and Policy Needs

Questions Posed to the Group: What are the R&D activities needed to overcome the priority barriers? What are the policies that would help to achieve our goals for this route?

Method: Each participant was asked to write his/her answers on an index card, and to distinguish between R&D needs and policy needs. Each response was read aloud, and posted on the wall under the appropriate stage of the priority pathway (Figure 2). Responses that could go into a number of categories were placed in the cross cutting heading. After all responses were posted and discussed, similar responses were grouped together on the board. Each participant was given 14 dots, and asked to place one of seven dots on each R&D need, and one of the other seven dots on each policy need that they identified as a priority (multiple dots could not be placed on one need by the same person). Needs that had been grouped were counted as one need. Priority R&D and policy needs were presented in the second day's closing presentation.

See the "R&D & Policy Needs" tab on the attached spreadsheet for index card responses, organized by priority votes.

Summary: Major research needs included genetic transformation systems for energy crops, establishment of national breeding centers; diversifying herbaceous energy crops, and better assessment of land production potential. Major policy recommendations included revisions to the 2007 Farm Bill to establish a working land policy for energy crops, policy measures to reduce producer risk, and workforce development, particularly in breeding.

Results:

- Steve Thomas:
    - Policy: Create a new land category (i.e. bioenergy crop reserve) with tax rebates/subsidies. Link this to a decrease in the defense budget.
    - R&D: Analyze the sustainability of having large acreage focus on energy crops (i.e. soil and water quality).

- Steve Long:

  - R&D: By 2010 we need a program to fund experiment stations for practical R&D on practical energy crops – develop a link to the actual growers.
  - R&D: Transgenetic systems in place to get genomics on crops.
  - R&D: Develop better trial information, including trial land.

- James Zhang:
  - R&D: Additional R&D on biomass storage.
  - R&D: Identify additional energy crops beyond switchgrass (native or non-native).
  - Policy: New CRP policy/land category.
  - Policy: Government-backed insurance policy for feedstocks.

- Nick Nagle:
  - Policy: Changes to CRP designations.
  - R&D: Energy efficiency needs to be increased in all conversion types.

- Maurice Hladik:
  - Policy: Changes to CRP.
  - Policy: GMO rules of engagement should be established.
  - Policy: Energy crops become…(?)

- Bill Belden:
  - Policy: We need to put policy in terms of working land. Policy to measure the level of benefit (i.e. how do we capture intrinsic value?).
  - R&D: Environmental benefits and cost/benefit analysis.
  - R&D: Processing and handling increase.

- Tom Foust:
  - R&D: Life cycle analysis on Wells to Wheels style.
  - R&D: Food, feed, fiber, fuel (4F) processing interface.
  - Policy: Energy crops focus in CRP policy.

- Ken Vogel:
  - R&D: Research teams need to include a variety of scientists, as well as be regionally based.
  - R&D: Production R&D in each major ag system.
  - Policy: Energy versus subsidized hunting.

- David Bransby:
  - R&D: Genetic improvement.
  - R&D: Improvement in conversion efficiency.
  - Policy: Production incentives and insurance.
  - Policy: Loan guarantees for conversion plants.
  - Policy: Getting plants built in 25 years on a scale large enough to produce the levels needed.

- Policy: Education systems geared towards this industry.

- Bob Perlack:
  - R&D: There needs to be an assessment of state of technology energy crops production to target R&D funds efficiently.

- Richard Hess:
  - Policy: Risk management policy for producers.
  - R&D: Pest control issues.
  - Policy: Minor use pesticides policy issues.

- Sara Bergan:
  - Policy: Farm Bill support for perennial crops.
  - R&D: Focus on other herbaceous crops (i.e. beyond switchgrass).
  - R&D: 5 Carbon and enzymatic flexibility.
  - R&D: Agronomic and genomic R&D for fuel conversion.
  - R&D: Carbon sequestration.

- Oliver Peoples:
  - Policy: USDA needs to get behind this.
  - R&D: Fuel experiment stations need to be up and running by 2007 – 2008.

- Kevin Kephart:
  - R&D: Public genomic development versus private; we need better communication between the two.
  - R&D: We need to look at more than switchgrass.
  - R&D: Conduct a local assessment of crop availability and characterization.
  - R&D: Economic, environmental, and sustainable risk management.
  - R&D: We need to quantify environmental benefits/impacts to avoid derailing by environmental groups.
  - Policy: Significant increase in investment in DOE and USDA, plus DOT and EPA.

- James Wade:
  - R&D: Business and economic plans for growers.
  - (Unassigned): Increase in deployment and extension.

- Terry Nipp:
  - R&D: Analyze the sustainability of feedstocks (i.e. how much can be removed?).
  - R&D: Develop a regional experimental design system with GIS.
  - Policy: Development of distributed infrastructure.

- Sara Bergan: Expand Title 9 in the Farm Bill.

- Oliver Peoples: Co-firing of energy crops would solve the energy balance debate.

8. Addition of Detail to Priority R&D and Policy Needs

Question Posed to the Group: What are the specifics that need to be conducted in each of the priority need areas?

Method: The group was asked to add more "meat" to the priority R&D and policy needs identified through the prioritization process. Group members responded at their own will and wrote their answers on an index card. The cards were posted under a heading created for each priority need. The priority needs addressed for this activity included:

1. Genomics, Genetics, and Transgenics
2. Identify Additional Energy Crops
3. Land Assessment Production Potential
4. Farm Bill

See the "Details for Priority Needs" tab on the attached spreadsheet for index card responses, organized by priority need.

Responses: Genomics, Genetics, and Transgenics

- Ken Vogel: We need to focus on forage breeding programs. We need funding to rebuild capacity (through Land Grants, ARS, or private entities).
- James Zhang: We need training and education programs to develop expertise in this area.
- Ken Vogel: We need improved plant material.
- Kevin Kephart: We need to screen species for breeding and agronomics.
- John Ferrell: We need educated breeders to do this.
- Kevin Kephart: An integrated team capability needs to be developed to do this.
- John Ferrell: Focus on the development of traits required for higher yields.
- Steve Thomas: Develop genetic confinement.
- Ken Vogel: We need to breed to specific conversion technologies.

Responses: Identify Additional Energy Crops

- James Zhang: Understand miscanthus at the molecular level to develop seed systems.

- Steve Long: Conduct a trial of various miscanthus varieties.
- Richard Hess: Propagation is an issue.

Responses: Land Assessment Production Potential

- Kevin Kephart: Integration of existing databases on this topic.
- Bob Perlack: ORNL is doing some of this already; there are questions as to the quality of the NRCS database.
- Steve Thomas: Are the State Ag Experiment Stations useful?
- Kevin Kephart: Yes, but they are not repositories of information.

Responses: Farm Bill

- Steve Thomas: Don't restrict land use policy to CRP changes.
- John Ferrell: Reauthorize and expand Title 9.
- Bill Belden: Expand in two ways: working land approach and CRP approach. Add points for energy crops under CSP. Use EQUIP (Environmental Quality Improvement). [CSP and EQUIP are apparently Farm Bill provisions or programs]
- Kevin Kephart: Add a biomass reserve under CRP to Title 9.
- Bill Belden: Use language to include dedicated cellulosic biomass energy crops.
- Sara Bergan: Land rent payments. Risk management funding and research and education funding through extension.
- Kevin Kephart: Appropriate demonstration projects in Title 9.
- Bill Belden: Get people to USDA Farm Bill meetings to send a concise message to Congress, re: Farm Bill changes/additions.

9. Identification of Federal Role in R&D and Policy Priority Areas

Question Posed to the Group: What is the Federal role in implementing the activities that you have prioritized?

Method: As the group responded to the question, answers were captured on a flip chart. The flip chart responses can be found on the "Federal Role" tab of the attached spreadsheet.

Responses:

- Steve Thomas: Genetics work should be conducted by both the Federal government and industry, but not necessarily through joint projects.
- Ken Vogel: Long-term, basic, high-risk research, and research that is for the public good, is the focus of USDA ARS. Low-risk, near-term work is conducted through state experiment stations through CSREES.
- Steve Long: USDA ARS should maintain corn and soybean germ plasma collections.
- James Wade: Federal government should build capacity through educational programs.
- James Zhang: DOE should do genome sequencing.
- Steve Long: USDA is importing germ plasm.
- Maurice Hladik: The Federal government should facilitate an interface between the farming community and the conversion community.
- Kevin Kephart: The Federal government should reengage the State Ag Experiment stations with a renovation of Hatch funds to focus on renewable energy.
- James Zhang: Deregulation of new plant species.
- Maurice Hladik: Look into the availability of DOD lands for crop production.
- Oliver Peoples: Provide matching funds to companies to reach commercialization.
- Bill Belden: Who is the coordinating force across agencies and industry?
- Steve Long: The Federal government should make international linkages.