Realistic Expectations for Woody Biomass Utilization

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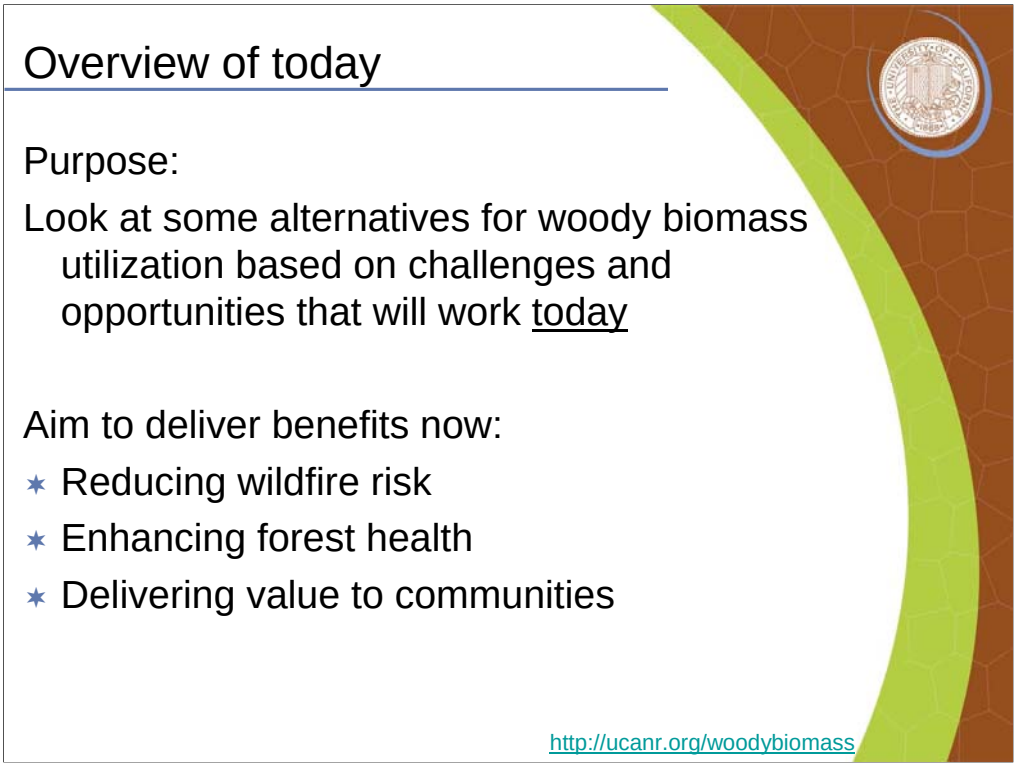
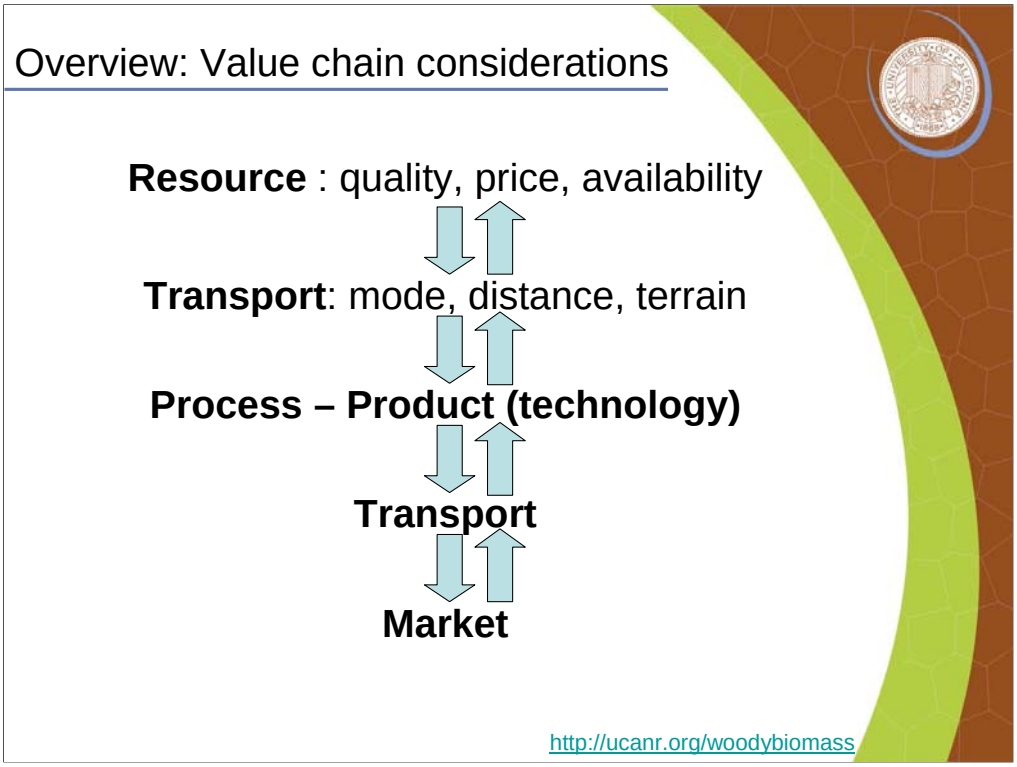


The work we do in partnership with the US Forest service in Region 5 (California) is focused on developing markets for woody biomass. While we are interested in biofuels and other developing technologies we are particularly interested in technologies and processes that are commercially proven and which can deliver benefits on the ground now. The wildfire risk is now and we cannot afford to keep waiting to develop utilization solutions for the material removed when treating vegetation on the landscape. This presentation is primarily concerned with California but has applicability to other parts of the United States.

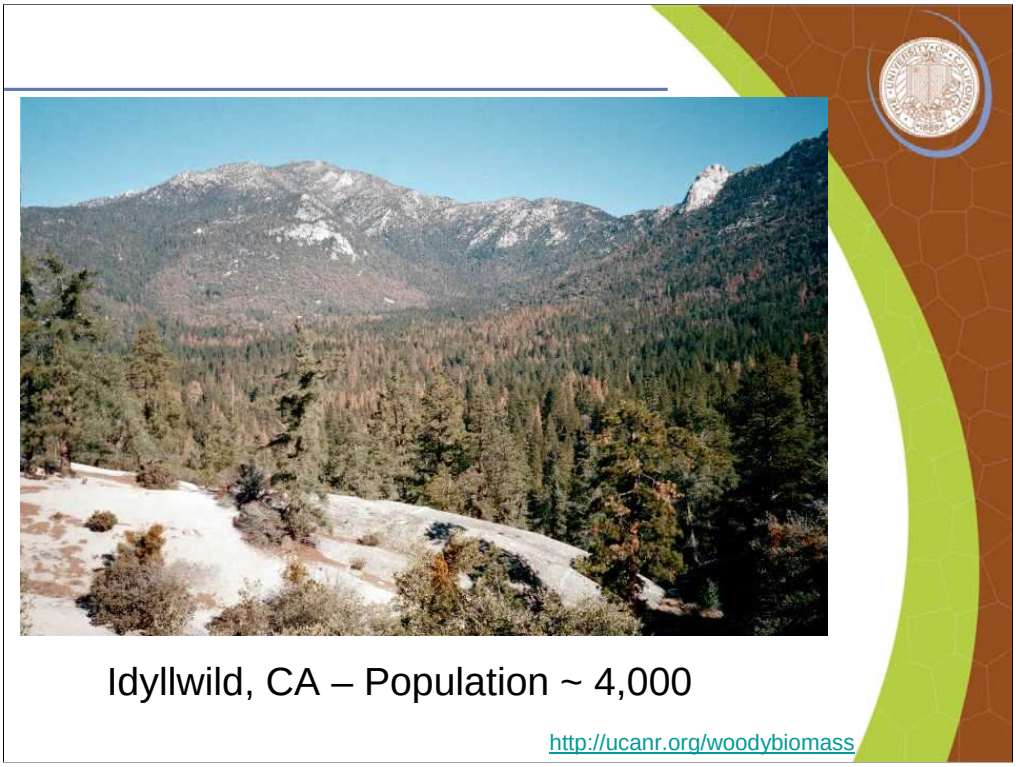
We will look at some of the basic concepts for project development, some product ideas based on a logical approach and then focus on some examples of new projects that are happening on the ground now.



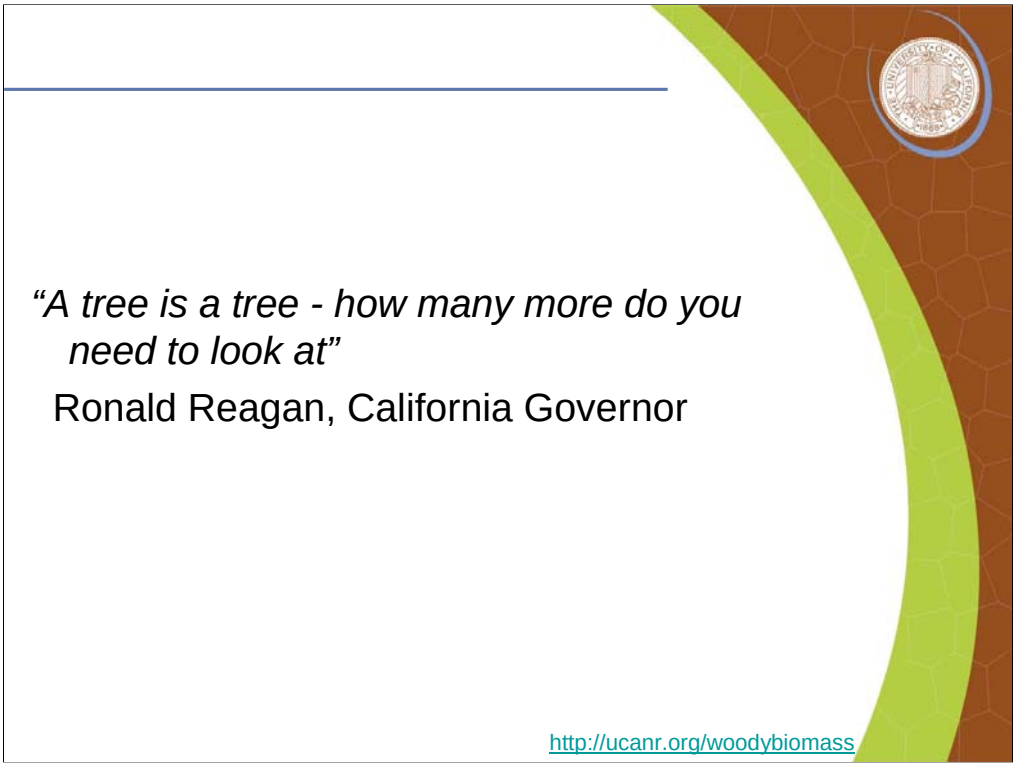
The value chain represents the basic steps in taking a feedstock (raw material) , processing it into a product and delivering it to market. Just because you can make a product does not mean there is a viable market for that product. Likewise just because there is a market for a product does not mean you will successfully be able to service that market (think of raw material specification, quality control, transport cost etc). When developing project concepts it is important to step back and think about the whole value chain.

Woody biomass includes forest based material (small logs, tops and slash), green waste, construction and demolition waste and agricultural residuals. The different sources have different price points and come in all shapes and sizes which affects your decision pathway with respect to what makes sense.

Changing land management practices with respect to public lands mean moving away from commercial timber production towards ecosystem restoration, fuels reduction and recreation. The goals of healthier forests and reduced fire risk create opportunities to add value and create jobs. We are looking at a different product mix, often less volume, less reliable and often projects will be net cost as opposed to net income.



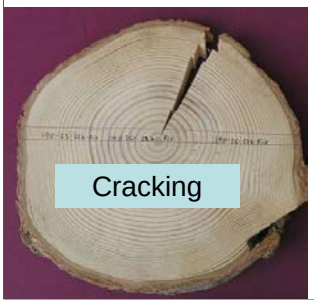
More people are choosing to live in rural areas and living in forested communities is desirable to many. Idyllwild in Southern CA is a stealth city of approximately 4,000 living in beetle killed forest that is at great risk from wildfire.

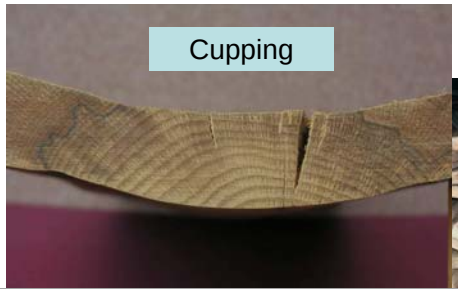


This quote was attributed to a former CA Governor. As foresters and wood scientists we know that trees (and other lignocellulosics) are heterogeneous and it takes effort to understand what product pathways may be suitable for different types of woody biomass.

Problems with smallwood?

- Raw material properties
  - Juvenile wood
  - Differential shrinkage
  - Knots
- Processing Cost
- Transportation cost





Juvenile wood comprises the core through the first 5 to 20 growth rings within a tree. Juvenile wood is different from wood derived from the outer growth rings. Its morphology means that it is prone to movement such as warp, sweep and twist. It is also prone to cupping as dimensional change in the tangential direction is twice as great as that in the radial direction. With smaller trees (and therefore logs) the impact of the juvenile wood becomes more significant. Even the best mills have problems with the effects of juvenile wood. This and the impact of working with many smaller logs (vs fewer larger logs) mean that sawmill efficiency becomes much more important. The message is that you can saw small diameter material but it is much harder to make the economics work especially in today's lumber market. Things like knots also have a proportionally greater impact in small diameter logs and will impact sawn lumber quality.

Raw material form is important

Every process has a raw material specification

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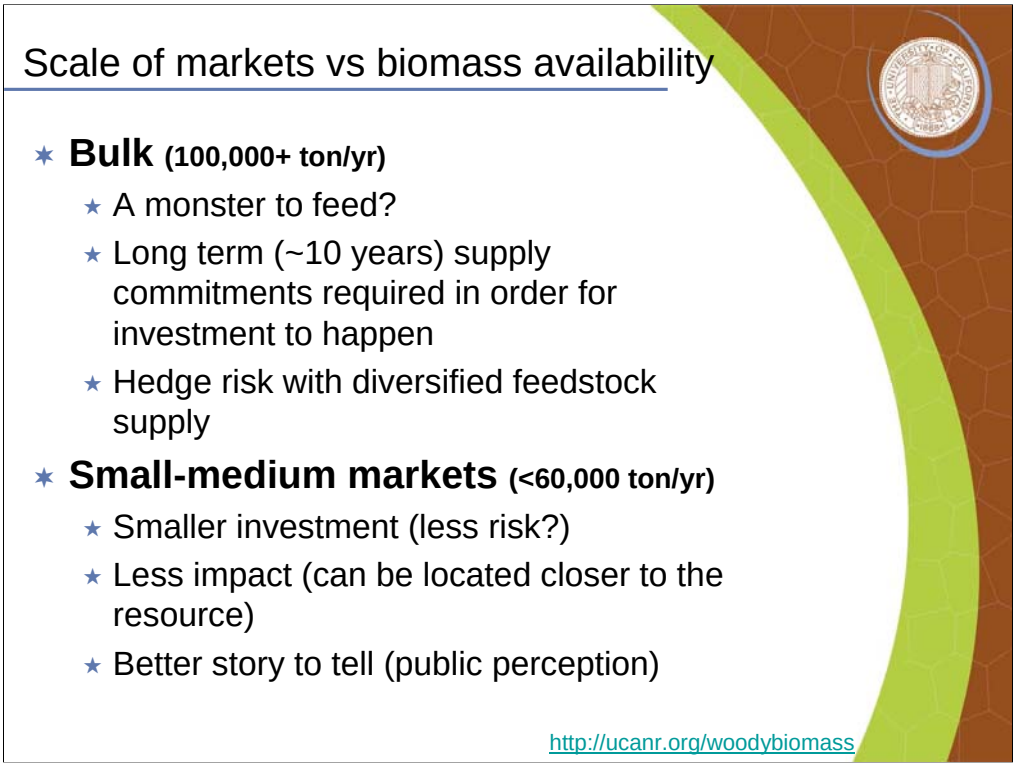
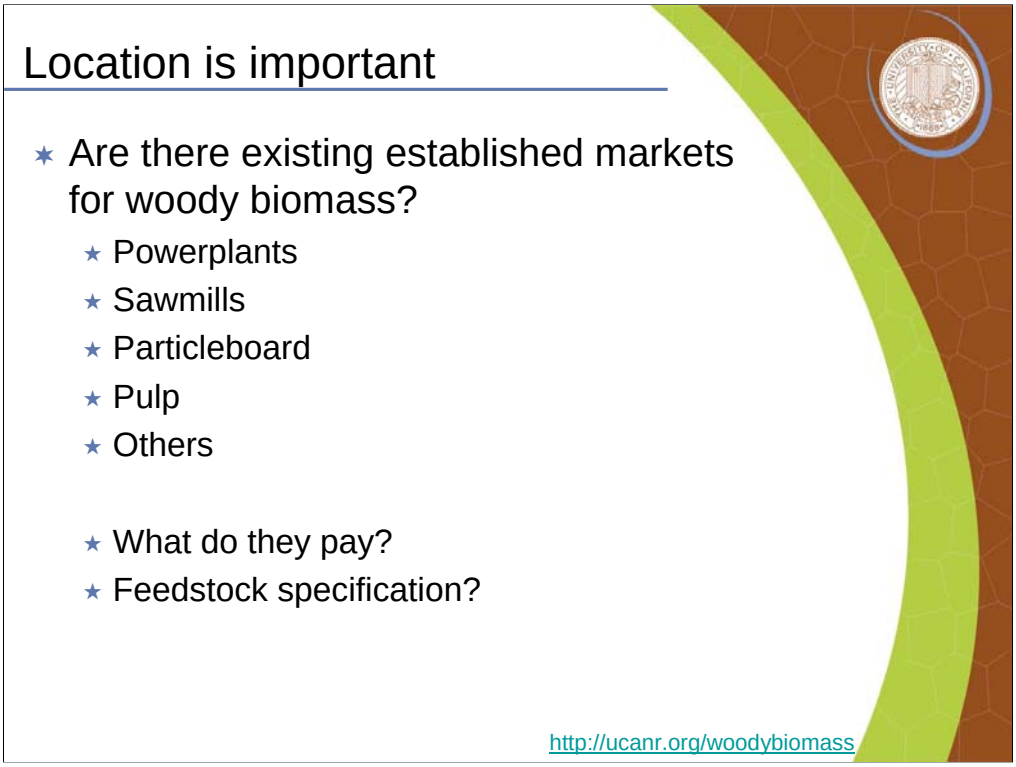
Every process has a raw material specification. You need to establish that the biomass available is capable of meeting that specification. If a process need a clean consistent chip then you will need to start with logs (that can be debarked and chipped). If the process can handle dirty chip then slash piles may be utilized after grinding.



Size of the facility is important. At a simple level, based on the fact that there is 20m acres of NFS lands in the State, you might think that California would be the ideal place to build large scale biomass utilization facilities. The problem is that raw material supply from Federal forest lands is to unreliable to support such investments. Therefore, larger scale projects need to hedge their supply chain risk by looking at the full range of woody biomass sources including National Forest, private forest, agricultural residues and urban sources.

Small to medium markets (up to 60,000 BDT/yr) are potentially less risky from an investment perspective. They also offer opportunities to be fully engaged with communities by delivering fuels reduction projects and possibly serving local markets while creating jobs.

Wood science and technology is extremely advanced and it is possible to make a range of chemicals, liquid fuels, advance fiber products from woody biomass feedstock. At present the problem is that few of these technologies are commercially deployed. Therefore we must be careful to ensure that projects undergo full due-diligence before committing time and resources. Factors to consider include economics, quality control, environmental issues, raw material supply, ability to sell product and does the technology work now?



Location is crucial in determining the opportunities for biomass utilization. This is in terms of the accessibility of the biomass, the availability of processing infrastructure and distance to market for products. Identifying existing markets is important as they offer opportunities for woody biomass utilization. You need to find out what their feedstock specification is and the prices they pay. Consider if this is compatible with the woody biomass that is available in the area. Existing markets make sense as they are already capitalized and have supply chains in place. More risk is often associated with new processing investments.

Innovation in Lumber Processing

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It is possible to saw small diameter logs and there are many modern sawing systems available that can efficiently make lumber from this material. This slide show an end-dogging system. The remaining sawmills in California have invested heavily in new technology to allow them to saw small diameter material as efficiently as possible.

Round Wood-Is Stronger and More Stable

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Trees grow in a cylindrical form because it is strong. Generally the cylindrical form is optimized for strength properties by nature. If you use logs in their natural form (after removing bark and some of the wood) you end up with a building material that is dimensionally stable and strong.

However, connecting roundwood is expensive and difficult compared to other wood products. It can result in beautiful and unique structures.

Post and Pole – more realistic for now

- Low tech
- Low investment ($1-1.5m)
- Big market in California

In the short term the agricultural market in California offers a significant opportunity for the use of small diameter logs. The market is one of the largest in the US and there is currently no serious production capacity within the state. For a higher quality end product and more product choices dowelling systems offer the best opportunity.

Breaking wood down into particles minimizes the impact of defects (knots, juvenile wood, insect galleries etc.)

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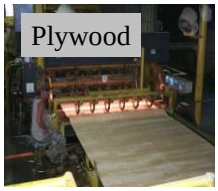
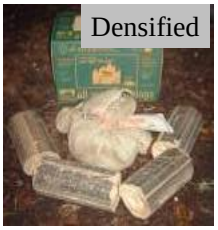
Breaking wood down is a way to reduce the impact of natural defects. By homogenizing the material the individual defects have less impact on the performance properties of the final product.

Creating uniformity





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Many existing processes use this principle to produce high quality predictable products.

Densified wood products are one product group that offers opportunities through breaking down forest biomass. The family of products includes brick and “presto” log type firelogs, wood pellets and log products that combine wood with petroleum wax to deliver a convenience product. Apart from the log products that incorporate an accelerant, no additives are added to these products. They have numerous advantages over cordwood or chip as a fuel including: higher energy density, consistent reliable product, clean, readily available.

Wood pellets

- Uses
  - Fuel (seasonal)
  - Animal bedding/litter
  - BBQ pellets
- Markets:
  - N America: 1.5 million tons/year
  - Europe: 10-12 million tons/year

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There is anecdotal evidence that demand in California is growing for this type of product. Currently there are few (~2) densified wood fuel manufacturing facilities within the State. Global markets are also growing, driven in part by coal power plants looking for fuel to co-fire with.

A typical US pellet mill is between 30-60,000 ton/yr. Operational scale is generally derived from the dryer required. A relatively large site is needed for storage of finished product prior to distribution in the heating season. Typical feedstock is clean sawmill residues. It is technically feasible to use a variety of biomass feedstocks but die wear is an issue (with contaminants such as silica) as is the finished pellet quality (and consistency). Opportunities exist to debark small diameter logs and produce a clean feedstock for pellet manufacture. Some processes also allow the manufacture of a brick type product using whole tree chips.

Niche woodchip and shavings

- Animal bedding (shavings) ($1m)
- Bio-filtration (chip) ($60k)
- Cattle corrals (chip)

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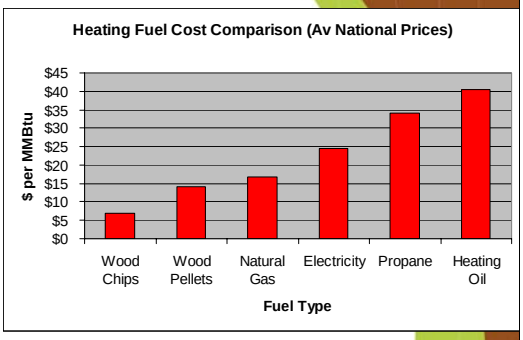
Other opportunities to serve the market for animal bedding. This represents an opportunity as the decline in the sawmill sector in California (and the current housing downturn) has meant that sawmill shavings are less available. Investment is relatively low and feedstock can be small diameter logs (with bark on). Wood chips are also used to provide a method of filtering odorous air. Large beds of chips are created on which bacteria are cultured. When the odorous air is passed through the bed the bacteria “eat” the smell. Cattle corrals where large woodchips (3-4ft deep) are used as the floor (it protects the animals feet, neutralizes odor – species dependant - and allows waste to pass through).

Small scale heat (institutional)

- Can be cheaper than alternatives – it is easy to calculate simple payback
- Carbon neutral
- Local market
- Opportunities for public buildings (10,000 sq ft to 1m+ sq ft)
- Permitting can be an issue
- Long payback period may be a problem (5-15+ yrs)



Source: US DOE Energy Information Administration, Sept 08

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Institutional heating systems also offer opportunities. The technology is available and proven. The Fuels for Schools program has implemented numerous projects successfully in other parts of the US so we have examples to learn from. For those that heat using oil, propane or electricity wood chips and wood pellets are significantly cheaper as a fuel source on a BTU (British Thermal Unit) basis. Payback period is based on the costs of installing a wood heating system vs the alternative. Permitting and air quality regulations may be an issue in some areas. Payback periods typically range from 5-15+ yrs which can be challenging for some projects. A good first step is to calculate current energy costs, wood fuel costs, and establish the level of potential annual savings.

Opportunities in California

- Existing facilities (sawmills, powerplants, panelboard)
- Small to mid-scale reliance on forest
- Local markets
- Linking fuels management with increased local benefits
- New facilities:
  - Roundwood
  - Densified wood fuels
  - Niche chip/shaving products
  - Heat
  - Power plants (CHP)

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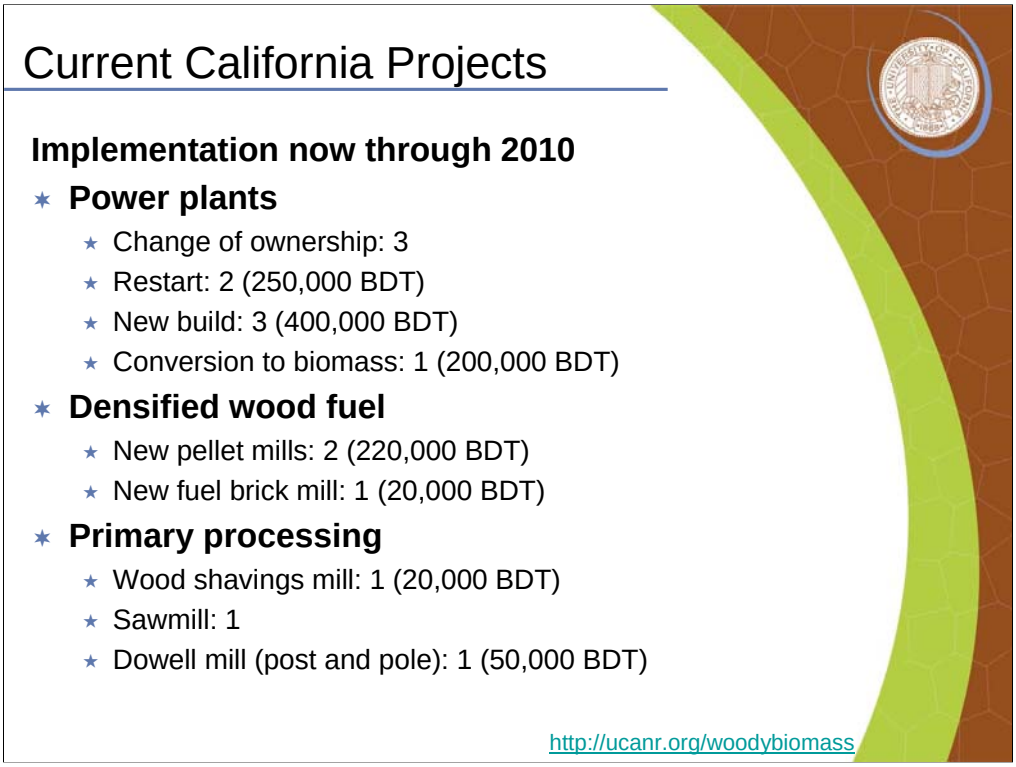
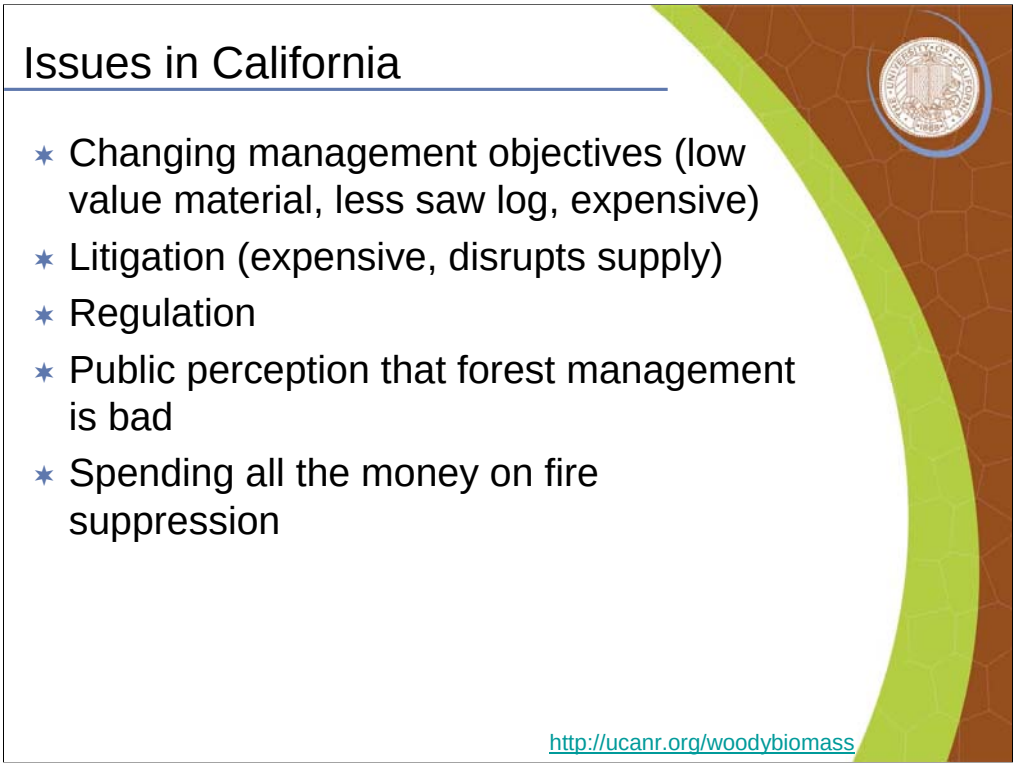
This is a summary slide. Powerplants were discussed in detail in another presentation at this conference and do represent a current opportunity.



This slide summarizes some of the current projects that are happening now or will happen in the next 2 years. Much of the new investment is in the opportunity areas identified earlier. These are actual projects with financing in place. We can see that there is potentially 1m BDT of new market for woody biomass coming online. Much of this capacity will rely on non-forest sources for its feedstock.



Some of challenges of developing new projects in California are summarized here.

Conclusions

- Woody biomass has unique properties
- It is possible to make many different products
- Economics and politics determine viability
- Fully assess value chain when developing a product offer [forest to market]
- Raw material supply is crucial for new investments and to maintain existing infrastructure
- Can land management objectives and regulations be compatible with existing and new industries?
- Product opportunities now:
  - Existing infrastructure (powerplants, sawmills…)
  - Roundwood (post and pole)
  - Densified wood products
  - Niche chip/shavings
  - Institutional heat

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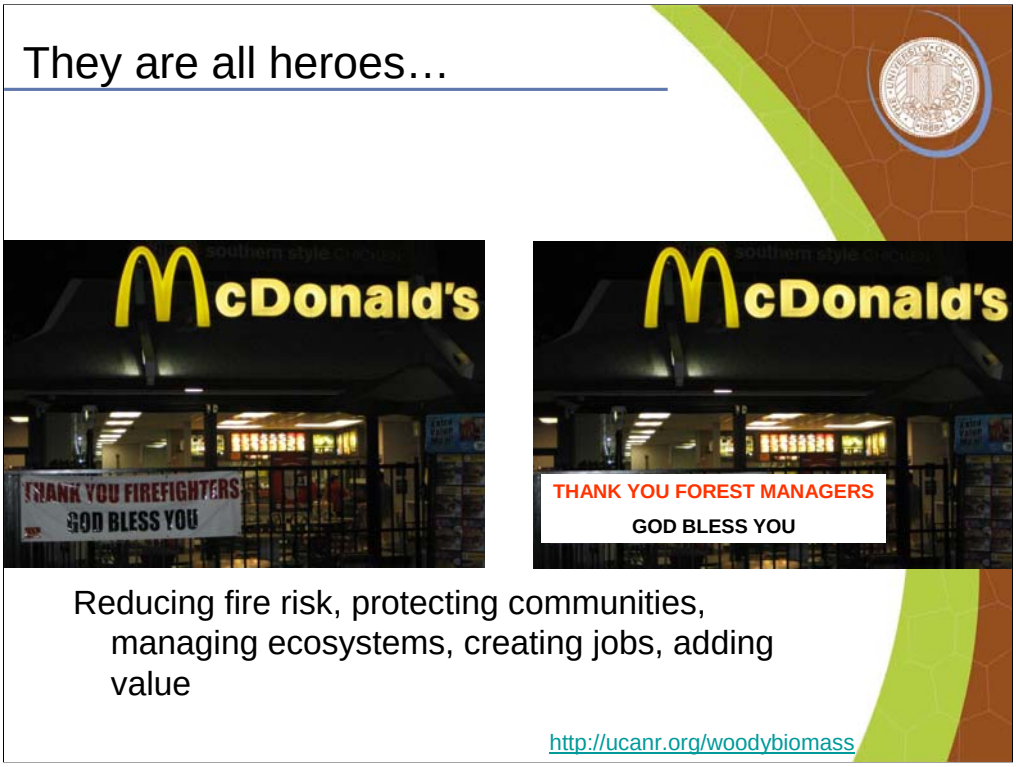

As I drive around the State I am always struck by the number of signs expressing gratitude to fire fighters in the fire season. Obviously communities and businesses are extremely grateful for the important job that fire fighters do. An observation is that no one ever thanks the land mangers and foresters for implementing fuels reduction or ecosystem restoration projects that also play a role in protecting communities. The problem is that fire is a "now" issue that is very visible (and real) as a threat and fighting fire has virtually a blank check. Forest management does not have a blank check and must go through the complex environmental planning process and inevitable litigation before anything can happen on the ground. Perhaps we should be trying to change society's perceptions of natural resource management to show that the job that foresters do is valuable and relevant. Communities and society need to understand that if we are ever to reduce the risk of catastrophic wildfire we need to invest in fuels reduction projects now. Foresters can be heroes too!

Thank you

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