VI. Chapter Three—Woody Biomass Utilization

Many of the forests of the Dry Forest Zone have an overabundance of small-diameter trees that result in elevated wildfire risk. Hazardous fuel reduction and restoration projects have increased the opportunities for removal of this material, but by and large, the traditional forest products companies in the zone do not utilize small-diameter trees and slash from timber harvesting operations. Across the zone, county commissioners, industry leaders, local businesses, agencies, landowners, and some conservation groups want to capture value streams from forest biomass while meeting their goals of community wildfire protection and risk reduction. There is a range of possible uses of woody biomass that could create economic value, benefit local communities and businesses, and support forest restoration. However, the types of biomass utilization that they support vary. These include on-site heat and power, energy generation, woody fuels and densified fuels, integrated community-scaled facilities, and institutional thermal heating systems.

First, there is strong interest in utilizing wood to produce thermal energy, particularly for space and process heat. Several sawmills across the zone already take advantage of their residuals to produce on-site heat and electricity. Second, many communities now see stand-alone electricity and combined heat and power plants for commercial electricity generation as the key to creating local jobs and wealth capture beyond the traditional forest sector. Third, there are businesses in and near the zone that sell biomass as wood-based fuel in the form of firewood, chips, or hog fuel. Other options include densified fuels such as pellets or bricks. Supply has outpaced demand for pellets in the zone's existing residential pellet market, and entrepreneurs are turning toward bulk pellet production for an institutional heat market as an alternative. Fourth, a few communities have pursued small, locally based initiatives that are *diversified* (produce a range of products) and *integrated* (systems for the site's production and consumption of energy, heat, and wood waste products are combined in a loop). These models maximize efficiency and are feasible for smaller entrepreneurs. Fourth, there is a growing institutional heat market for thermal biomass utilization in public and commercial buildings as communities realize the potential cost-savings of conversion from fossil fuel heating sources, especially heating oil. Finally, there is also localized interest in continuing to investigate potential uses of wood to produce bio-oil, or in pursuing a pyrolysis process that would produce a synthetic gas and would produce bio-char, a byproduct to be used as a soil amendment or in carbon sequestration.

This chapter discusses this range of woody biomass utilization across the zone, highlighting both innovations and challenges to business and supply viability. Although activity around biomass utilization varies, the zone is home to several clusters of business growth and biomass heat use that offer opportunities for further development and innovation. In particular, the emergence of an integrated, small-scaled cluster or campus model for biomass utilization holds promise for durable local economic development and small business involvement.

The Geography of Woody Biomass Utilization

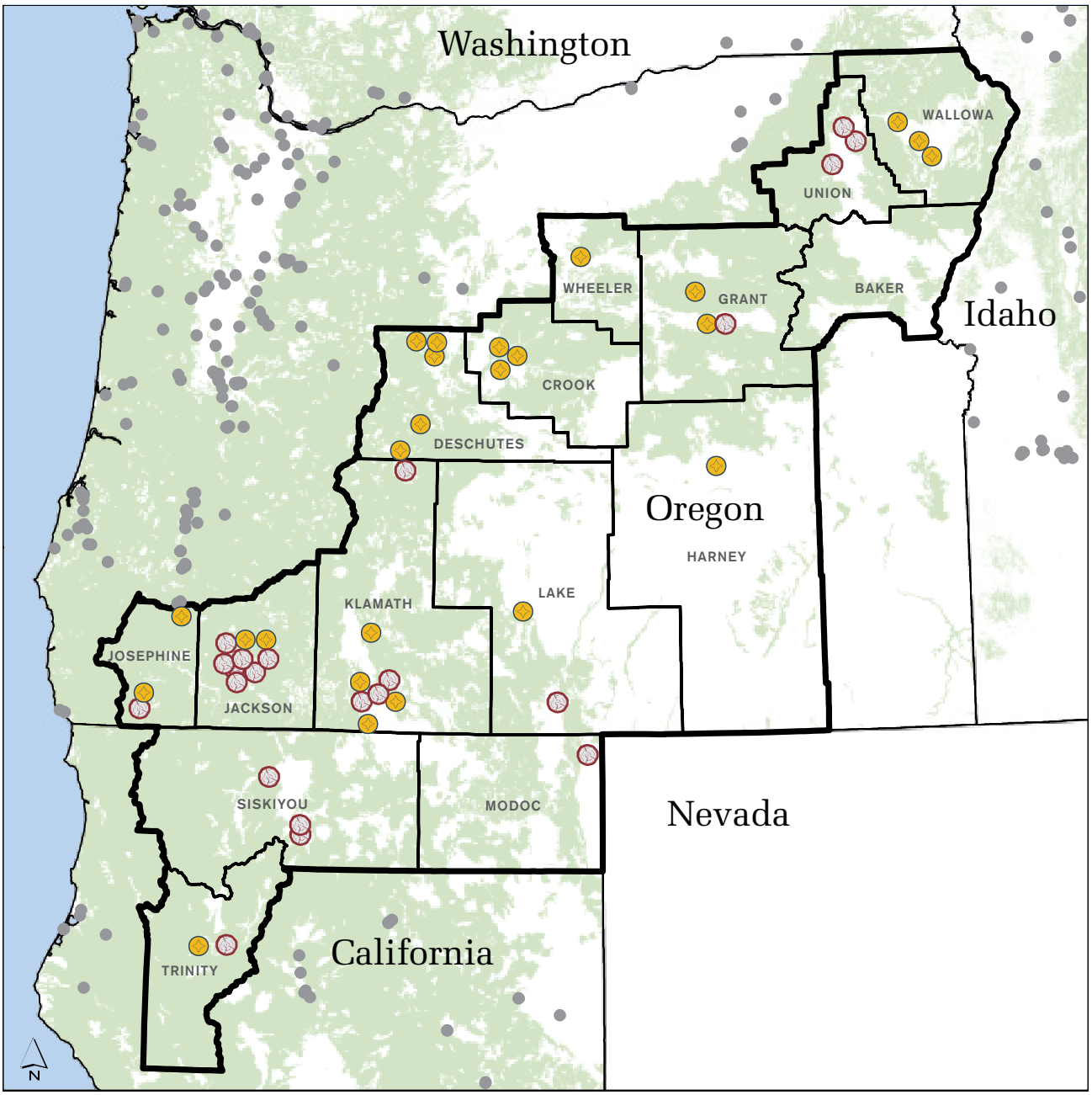
There are several different types of infrastructure that are part of biomass utilization: primary wood products manufacturers, cogeneration (combined heat and power) plants, densified fuel facilities, integrated community-scaled campuses, and institutional buildings that utilize wood-based energy for space heating. Primary infrastructure such as sawmills provides employment and utilizes larger-diameter logs, which remain the foundation of timber markets. Sawlog production capacity is linked to biomass utilization because these facilities produce a volume of residual material (such as sawdust) that can be used in secondary manufacturing to produce pulp and paper, engineered panel products, densified wood fuels such as pellets or bricks, and landscaping products.

The zone is home to over thirty primary processing facilities *(Figure 13, page 37)*. The traditional wood products infrastructure across the zone is significantly smaller than it was even a decade ago as a result of reduced timber harvests, industry consolidation, and globalization of markets. Most of the mill infrastructure is located within the southwest corner of the zone. In Oregon, only nine mills remain east of the Cascades. Traditional industrial mills are

FIGURE 13

Primary Wood Products Processing Facilities

Dry Forest Investment Zone



Data Source: EWP; US Forest Service

Primary wood products processing facilities

0 100 Miles

- Non-traditional and community scale
- Traditional
- Facilities outside the zone

not currently operational or do not exist in Wallowa, Baker, Wheeler, Harney, Crook, or Deschutes counties. In northeastern Oregon, log markets are oriented toward mills in Union County; in central Oregon, to one mill in northern Klamath County or to Warm Springs, north of the zone; in southern Oregon, to mills in Jackson, Klamath, and Lake counties; and in northern California, to a number of mills across the three counties. Depressed log and housing markets currently are putting additional pressures on the viability of the industrial infrastructure that remains.

Additionally, there are family-owned or community-sized sawmills operating and active primarily in non-commodity and niche markets dispersed across the zone, including post-and-pole facilities and custom small-scale mills that produce beams, timbers, and finish goods (e.g. trim and molding). Central Oregon is home to a number of these businesses. This latter group is loosely networked through the Healthy Forests, Healthy Communities Partnership, which provides small business development and marketing support to similar businesses in the Pacific Northwest.

Both the larger and the community-sized processors in the zone face longhaul distances from harvesting to processing across a dispersed geography. The industry has struggled to adapt to the shift in management direction on the public lands that resulted in less timber availability and a focus on small-diameter removals. In two locations, traditional industry players have retooled their facilities to use a higher percentage of smaller logs. Biomass utilization processing capacity has emerged in several forms, including colocation of new manufacturing equipment with existing infrastructure, development of symbiotic relationships between new developing businesses, and energy generation (heat and power) that can be utilized by an on-site consumer.

Energy production used in an industrial process as well as both existing and planned producers and consumers of wood-based fuels are located across the zone *(Figure 14, page 38)*. Most of the traditional sawmills utilize their own residuals in a combined heat and power system (CHP) to generate steam to use as process heat in their dry kilns. Some of the heat is used in turbines to generate electricity. The electricity is either used on-site or sold back to the grid. Currently, the only stand-alone facility to produce electricity from wood waste is Biomass One in Jackson County. However, this facility is located directly adjacent to several mills and has had close access to urban wood waste as a byproduct of the construction industry that is rapidly growing in southern Oregon. Over the past five years, several stand-alone power generation facilities have been proposed in central Oregon. The scale of these proposals has ranged from 15 MW to 50 MW.

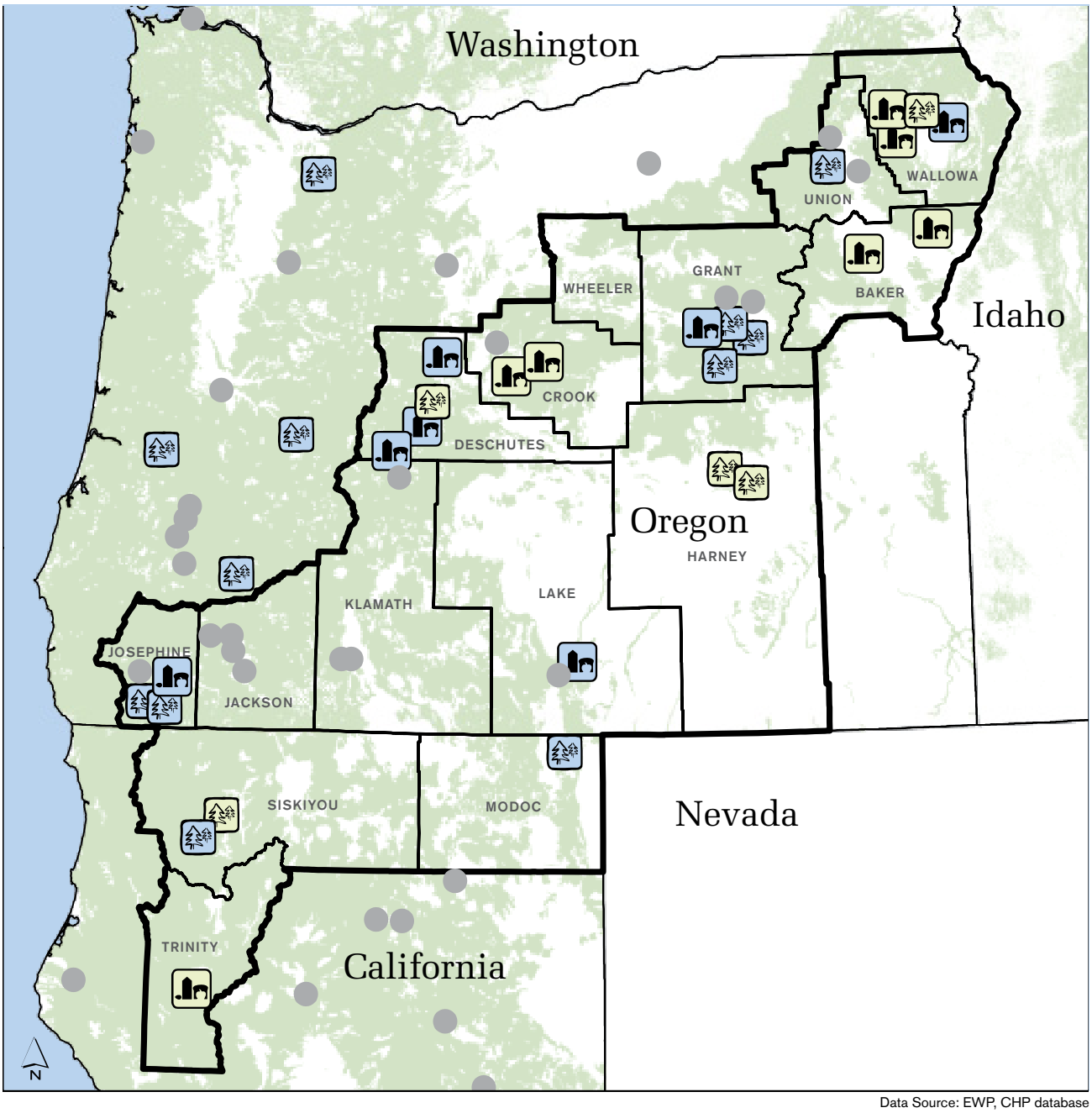
Wood-based fuels include densified fuels, firewood, chips, and hog fuel. As in energy generation of electricity or heat, manufacturing of densified wood-based fuels (pellets, briquettes, bricks, or other densified shapes such as "pucks") depends on access to a supply of wood residuals. The wood fuel industry has traditionally used sawmill residuals, (hog fuel, shavings, and sawdust) from lumber mills and other primary processors almost exclusively. Pellet production can be part of a mill's product lines, or it can take place at a dedicated facility. Several existing companies, such as Bear Mountain Forest Products, Western Oregon Wood Products, Frank Pellets, and Blue Mountain Lumber, produce pellets, but all are located just outside the boundaries of the zone. There are current plans to add pellet production in several locations in the zone. For example, an expansion to include the production of wood bricks at Integrated Biomass Resources in Wallowa County is taking place next to a post-and-pole plant owned by Community Smallwood Solutions.

Other wood-based fuels businesses range in size and capacity. Firewood businesses may harvest wood themselves or purchase "ends" from mills. Most firewood businesses in the zone are at a scale large enough to market outside their local community but lack the scale of volume to be attractive to a regional firewood distributor. Several of the firewood producers have accessed larger, regional markets but strictly as a spot market supplier. Chips and hog fuel have traditionally been used by the forest products industry in producing pulp or engineered wood panels, or to fire cogeneration facilities. This material can also be utilized in heat-only applications to provide heat at institutional buildings. However, smaller heat loads will tend to favor the use of pellets, whereas residential customers can use wood bricks as supplements to traditional firewood. Both

FIGURE 14

Wood to Energy Market

Dry Forest Investment Zone



Data Source: EWP, CHP database

Existing Planned

0 100 Miles

Producers of bulk biomass fuels (chips and densified fuels)

Consumers of bulk biomass fuels (thermal heating)

Industrial electricity and heat facilities (stand alone and mills)

of these sectors represent an important component of the future market for wood-based fuels.

Producers of wood-based fuels would benefit from having a robust regional market for their products. Currently, there is a growing degree of interest in dramatically expanding the use of wood to produce thermal heat for commercial and institutional facilities in the zone. Retrofitting of petroleum-based fuel boilers to consume wood fuels has become a new trend. In eastern and central Oregon, several public facilities have undergone or planned retrofits. Harney County's high school and hospital both operate on pellet boilers; the Enterprise school in Wallowa County utilizes wood chips to produce space heat; Grant County's airport is currently installing a pellet boiler; the new Deschutes National Forest headquarters will include a wood-based fuel boiler; the Blue Mountain Hospital in John Day is seeking financing for a retrofit; and several projects in Deschutes and Crook Counties are in development. Most of these consumers are advantageously located near regional suppliers, including a planned pellet plant at Malheur Lumber Company in John Day. In southern Oregon, two public schools in Josephine County received ARRA funding through the state to pursue retrofits of existing heating oil boilers. In addition, conversations have begun about using wood-based fuels in district heating applications in Fossil, the seat of Wheeler County, and Burns, the seat of Harney County.

Although such alternative uses for woody biomass to produce bio-based products (such as bio-oil, and biochar) are not as well developed as other uses for woody biomass, a new business in Baker County has developed a pyrolysis process for processing submerchantable materials and hopes to operate a mobile plant that can work in the woods, reducing transportation costs. Currently, this project is in infancy.

Trends in Woody Biomass Utilization

There are four trends of note in woody biomass utilization in the zone: 1) interest in energy generation focused on electricity; 2) interest in a diversified and integrated community-scaled model; 3) a new businesses model that would utilize a combination of forest harvesting slash and sawmill residuals to manufacture densified wood fuels for new markets; 4) and the growth of an institutional heat market.

First, many communities desire stand-alone electricity or cogeneration plants that will produce electricity for the grid and provide a stable stream of jobs. While these plants could potentially provide employment, their development relies on the interest and involvement of investors typically from outside the zone and would likely not provide opportunities to retain many profits in the local economy. In Oregon, strict zoning laws can make city lands less amenable to businesses, and county governments must work to ensure access to development sites and social license for a large plant. These investors may not understand or be committed to the needs of the community. They require available financing for the up-front costs of capitalizing facility construction, which can be over $1 million per planned megawatt, and to make such an investment, must have a guaranteed future supply of biomass materials. Coordinated Resource Offering Protocols or "CROP" models have been developed to help predict a five-year supply for investors. In central Oregon, the collaborative group Central Oregon Partnership for Wildfire Risk Reduction (COPWRR) has provided CROP analyses to several potential investors. This has led to proposed cogeneration plants in Prineville and La Pine, but most of these proposals have not come to fruition. Biogreen Sustainable Energy of St. Helens, Oregon, has purchased industrial parkland in La Pine, established supply partnerships, and applied for federal funding to build a 15 MW plant. Stakeholders in central Oregon continue to seek investment in biomass energy generation, but a lack of primary processing capacity limits access to infrastructure and supplies of residuals.

In northern California, colocating new energy generation with existing manufacturing infrastructure offers opportunities as well. Trinity River Lumber in Weaverville has proposed a cogeneration development with the City of Redding Utility District wherein Redding would own and operate a cogeneration facility powered by mill residuals at Trinity River Lumber, and sell the electricity back to the mill for their portfolio as well as for use in Trinity Lumber's dry kilns. However, Trinity River Lumber's mill has since burned down and this project has slowed. The most mature project in Siskiyou County is the pending construction of a CHP facility at Roseburg Forest Product's Mill in Weed. Environmental appeals surrounding their air quality permit are a substantial

impediment to this project being constructed and operating. This model for energy generation may be more feasible than stand-alone plants as it accesses some of the supply need from the existing primary processing infrastructure and has an additional revenue stream by capturing and selling the heat energy.

A second trend has been toward diversified and integrated community-scaled model of biomass utilization. This trend represents a way to surpass the obstacles that larger plants face and to grow local business capacity. The opportunity to develop colocated or on-site capacity to utilize small-diameter trees, harvesting slash, and sawmill residuals is innovative because it could help combat the current economic challenges of biomass utilization, diversify revenue streams for existing manufacturers, and take advantage of transportation and handling economics. In response to the low value of the raw material, businesses are looking to integrated businesses as a way to lower site development costs, share equipment, lower operational costs by producing energy on site, and developing a diversified product line that can respond to changes in the market. These business arrangements could be tremendously valuable to reduce production costs and, thus, add the most value to woody biomass, as well as the broadest range of benefits to communities and businesses in the zone.

These developments have occurred across the zone in the communities where nonprofit organizational capacity is high and collaboration has been ongoing for years. Wallowa County and Trinity County respectively have pioneered these integrated "campuses" with the intent of promoting both ecological and economic viability in their public lands and communities. In Wallowa County, this campus began in 2004 with Community Smallwood Solutions, a post-and-pole business. In 2009, Integrated Biomass Resources colocated at the post-and-pole site to utilize residuals and log downfall for chips and firewood. Integrated Biomass Resources is currently installing equipment that will allow it to produce puck briquettes. Wallowa Resources has been instrumental in supporting and coordinating these business efforts. In Trinity County, the Watershed

Research and Training Center has purchased a post-and-pole peeler and small-diameter sawmill to form the Hayfork Integrated Campus. They are working to add a firewood processor, pellet plant, and potentially a small CHP unit. These integrated facilities have the potential to produce a diverse range of products, efficiently utilize woody biomass, and support local entrepreneurship. However, the post-and-pole producer at the Wallowa campus has relied on private supply in lieu of the planned restoration byproducts from the Wallowa-Whitman National Forest since active restoration has been slow to develop. The Hayfork Integrated Wood Campus is not currently processing materials due to poor market conditions.

Other plans for integrated campuses are slowly emerging in the zone as entrepreneurs and businesses realize the advantages of this model and nonprofit organizations provide resources and support to pursue it. In consultation with the Central Oregon Intergovernmental Council (COIC), Quicksilver Contracting has applied for federal grants to create a smallwood processing yard in partnership with other local businesses in La Pine. This facility would have post-and-pole, chipping, grinding, and firewood capacity, and would meet a critical need for biomass utilization from the forests of central Oregon. In Josephine County, A3 Energy Partners is currently in the feasibility stage of developing a brick and pellet mill at Rough and Ready Lumber Company's sawmill site in Cave Junction.

Third, due to market conditions, there is a trend toward bulk, distributed densified fuel production. Traditionally, densified fuel production in the zone has largely consisted of bagged, high-quality and low-ash pellets for residential markets. But in 2009, demand for pellets leveled off as a result of the housing market downturn. Supply became greater than demand, causing many of the large pellet plants adjacent to the zone to curtail production. As there is currently an overcapacity of producers for this market, entrepreneurs in the zone have shifted toward a model of bulk pellet production for thermal heat consumers such as municipal facilities. This pellet production will rely on slash and biomass removed from the forest. Malheur Lumber Company in John Day will begin construction in the summer of 2010 to add capacity to its existing mill. Using grant funds acquired through the American Recovery and Reinvestment Act (ARRA), Malheur Lumber will contract with A3 Energy Partners to design and build a small wood pelletizing and briquetting line to complement its existing wood shaving product. This will allow the mill to purchase small-diameter logs currently without a market and utilize its own sawmill residuals. The pellets and bricks will be distributed by Bear Mountain Forest Products, a regional company with twenty years of experience manufacturing and distributing wood-based heating fuels in the Pacific Northwest.

There is other potential to pursue similar ventures in other areas of the zone, including the A3 Energy Partners project in Josephine County and the future pellet plant at the Hayfork Integrated Wood Campus. JTS Animal Bedding in Deschutes County, which produces shavings for animal bedding from both regional pine and nonregional Douglas fir residuals, has developed a new market linkage by partnering with Pacific Pellet. Pacific Pellet has begun to build a pellet plant in Redmond, and JTS will supply their shavings residuals to this new facility.

Fourth, local and external markets for the wood-based fuel products (both densified and traditional fuels) of the zone would provide this institutional market, revenue to offset the costs of forest treatments, and additional value streams for the forest products industry. Entrepreneurs in the zone are seeking to develop this market in response to the challenges of pellet overproduction. Comparatively, energy costs are reduced by three times when heating systems are fired with wood-based versus petroleum-based fuels. In addition, much more of the energy spending stays within the regional and local economy. In its first year, the wood-fired boiler (wood chip fuel) at the Enterprise School in eastern Oregon reduced heating costs from $125,000 to $25,000, saving the local school district (and the state) $100,000. In addition, the feedstock was procured from a nearby post-and-pole operation, injecting $25,000 into the local economy. This project and linkage is a model for future developments elsewhere in the zone; an opportunity to develop clusters of institutional heat demand exists in eastern, central, and southwestern Oregon. The expansion of the market will be tied to the strong confluence of biomass utilization businesses and partnerships that can provide durable supplies of densified fuels.

Growth of similar market linkages and supply networks will be crucial to the promotion of a broader thermal heat market.

Challenges to Woody Biomass Utilization in the Zone

Despite the number of promising developments in biomass utilization across the zone, this nascent industry faces challenges in supply, access to capital, entrepreneurial capacity, and the momentum of emerging markets.

The biomass industry relies on the by-products of other industries for its raw materials. This supply includes the residuals from forest products manufacturing and in-woods biomass from forest management. Investors and project initiators require reliable estimates of available supply when assessing business feasibility. Most often this is articulated as a need for a "guaranteed supply" from the federal land management agencies. The pace of restoration activities on much public land in the zone has been slow due to lack of agreement on forest management and limited funding and staffing in the Forest Service and BLM. Additionally, the demand for commercial timber has slowed substantially due to the recession and drop in housing markets, in turn reducing wood products manufacturing activity.

Second, most biomass business plans require a funding portfolio that include private equity, grants, loans, or tax incentives. In the current economy, access to capital is a formidable challenge. The recession has tightly constrained capital at many levels. Financial institutions now require higher levels of due diligence and documentation prior to providing capital due to the increased risks. Although sources of capital do exist, most are too large, too small, or too complex to meet the needs of most entrepreneurs in the zone. For federal funding sources, the size of grants is most often the problem. For example, the federal Department of Energy has made millions of dollars available for renewable energy but few rural communities have the capacity to effectively compete for a $100 million award. For private funding sources, the rate of return is most often the biggest challenge. Most private equity partners seek a higher rate of return than what most small-scale biomass businesses can provide. Sources of capital that fit rural communities and the capacity of their business partners still need to be further developed for biomass utilization.

Third, there is not currently sufficient entrepreneurial capacity in many zone businesses to navigate through the processes of capital acquisition, feasibility analysis, and business plan development. Entrepreneurs, business owners, and facility managers need assistance to best identify and access suitable methods for building a successful biomass utilization plan.

Fourth, densified fuel markets are in a state of transition. As was discussed earlier, the region has a surplus of pellet manufacturing capability and demand for residential bagged pellets is down significantly due to lack of new housing starts, low energy prices, and a weak economy. The weak economy has affected demand for pellets for those with existing pellet stoves as well. Most residences with a pellet stove also have traditional (electric or fossil fuel) heating sources. Residential pellets require customers to purchase their supply in advance. When lean economic times combine with warmer winters and low fossil fuel energy prices, many customers tend to rely more heavily on traditional heating. Lack of new home sales has hurt demand for pellets significantly but so has a service delivery model that requires up front payment compared to more traditional systems where the customer pays for their use at the end of the month. Entrepreneurs in the zone are looking toward a new bulk institutional heat market for densified fuels, but this market is emerging and needs to be built.

Opportunities

The opportunity for biomass utilization to foster job creation and contribute to healthy forests rests on creating business models that respond effectively to the industry's current challenges. Both the renewable energy sector (electricity and thermal energy) as well as other more traditional biomass products (such as post and poles and animal bedding) hold promise for innovative business models. Opportunities to develop biomass utilization in the zone include: 1) new supply streams; 2) integrated, small-scale facilities; 3) new forms of small business assistance; and 4) market adaptations.

First, businesses that have been dependent on mill residuals could utilize new raw materials (such as forest biomass and harvest slash), which are less subject to price increases and less likely to create competition for supply with existing industry. However, limited active public lands management in many areas of the zone hampers a federal forest supply of forest biomass and removal of materials in steep areas can become costly. In response, business models are utilizing new supply streams. These potential streams include private lands, juniper on private or public lands, and tribal lands. Many private landowners in the zone have shown interest in participating in biomass as an alternative value stream, and investors such as Biogreen Sustainable Energy in La Pine plan to utilize supply from private lands. Biomass utilization could also potentially help facilitate restoration and stewardship on privately owned forests. Private landowners across the zone have expressed their desire to restore their forests, which have become degraded from lack of management, and find revenue streams at a time when log markets are difficult to access. One private land management issue in particular is the spread of western juniper, which inhabits significant areas of private land ownership in eastern, central, and southern central Oregon. This species has expanded beyond its historical range of variability and impacts hydrology. Juniper has no traditional use and is difficult and expensive to harvest and process. Although a few small sawmills produce juniper beams and lumber, much of the trees needing to be removed for restoration are not fit for this purpose. The Prineville Juniper Working Group has met for several years to assess juniper utilization options in central Oregon. There is some interest in furthering the use of juniper as firewood, particularly targeting urban markets outside of the region. Other stakeholders would like to see juniper from private lands used in a biomass energy or densified wood fuel facility. One pellet manufacturer has indicated an interest in locating in southeastern Oregon to utilize juniper in proportion with other species.

Tribal managers of lands in and near the zone also plan to use their lands for forest biomass supply. The Warm Springs Tribe, immediately north of the zone in Jefferson County, has plans to expand its existing biomass energy capacity to 20 MW for electricity production with biomass from reservation lands.

The Klamath Tribes in southern central Oregon are currently attempting to increase their landholdings and use their new acquisitions to supply a planned integrated green energy facility. Biomass utilization offers both tribes and private landowners the opportunity to manage their lands and capture an alternative value stream; however, the feasibility of this capture will rely on the availability of forest management and technical assistance, and the aggregation of landowners to effectively partner with businesses.

Second, a diversified, integrated, small-scale model can also help create a more stable supply loop among other benefits. Several small-scale facilities or co-location plans are either in development or are being explored across the zone. Integration or co-location will lower site development costs and operation costs, lower permitting fees and shorten the development timeline, take advantage of an existing trained workforce and raw material streams. Central to this would be linkage of existing traditional wood products infrastructure to developing markets in the zone for residuals (densified wood fuel manufacturers and wood-chip fired energy consumers). The Siskiyou Woody Biomass Utilization Group in northern California is an example of an interagency organiza-

tion that has recently formed to help support these market linkages. Products from integrated facilities include wood shavings, bulk and bagged pellets, chips, bio-bricks or pucks, commercial firewood, and combined heat and power. A diverse product line would add resiliency to the balance sheet and allow the facility to capitalize on emerging markets or price fluctuations. Production facilities appropriate in size to the current and projected supply of biomass in the region will lower transportation costs and may garner more community support.

Third, there are opportunities to help local entrepreneurs develop the business capacity necessary for successful biomass utilization. Although there is much interest across the zone in these types of projects, there is also a general lack of knowledge regarding project specifics, such as financing, ownership structures, technology, suitability of feedstocks, and timelines for project development. Better understanding of the components of institutional heat projects that would enable community leaders and facility managers to make the best-informed decisions for investment. New partnerships and business linkages could create sources of technical assistance and training. In Wallowa and Trinity counties, nonprofit organizations have provided assistance with business planning and the risks of initial capitalization. There is also a need for support for public and market policies that can provide accessible funding and programs to small businesses. The Rural Voices for Conservation Coalition (a policy coalition that Sustainable Northwest coordinates) has a biomass utilization working group that works to inform decision-makers about policy priorities to foster sustainable renewable energy use. Awareness of the multiple benefits of biomass utilization to forest restoration, carbon dioxide offsets, and socioeconomic outcomes could help encourage state and federal investment.

Fourth, biomass utilization businesses need proactive and strategic market approaches. There is are opportunities to access rural and urban markets both within and external to the zone to achieve sufficient economies of scale. Most of the communities in the zone are rural and not heavily populated. Successful business models can operate in the zone while also seeking a share of larger urban markets. There is also an opportunity for small-scale producers and larger manufacturers to network to provide a broader range of market outlets for forest managers and a larger market presence with customers. One example could be the development of a firewood cooperative that pooled production to capture a larger, more regional market opportunity that individual businesses would not be able to meet.

Further market opportunities are the development of demand for commercial and institutional heat. This offers several important competitive advantages for biomass businesses in the zone. First and foremost, it is an untapped market segment that is experiencing strong annual growth. Second, biomass thermal heating systems can utilize a bulk pellet that contains a higher level of foliage and needles. This allows the facilities producing bulk pellets to utilize restoration by-products, such as material forest health treatments and harvest slash for which there is limited competition. Third, commercial and institutional heat users would be less likely to switch to fossil fuel as biomass thermal systems offer strong energy savings compared to fossil fuel sources. Lastly, the size of the commercial or institutional market may be able to generate a demand for increased production capacity over time.

Communities and businesses across the zone are interested in the promise of woody biomass utilization to create economic opportunities and support forest stewardship. A distributed network of appropriately scaled combined heat and power facilities offer the potential to utilize the byproducts of forest restoration across the zone while providing employment opportunities and inputs to local economies in multiple communities. Community-scaled integrated models have the capacity to expand local entrepreneurship, support business partnerships, and provide socioeconomic benefits while producing for a regional market. The lessons of the early innovations and successes in eastern Oregon and northern California can be shared across the zone to help confront its obstacles of isolation from markets and transportation corridors. The zone is poised to further its existing innovations and use biomass utilization as a tool for sustainable forest stewardship and community development.