



# IFWG Task #3: Sustainability of Forest Biomass Utilization

## Research Program Update

Bill Kinney

April 29, 2010



## Guiding Research Questions

- **How can forest biomass utilization be conducted to ensure ecological and economic sustainability?**
  - What are the direct effects of utilization treatments on relevant ecological systems?
  - How does utilization affect the impacts of fire disturbances on relevant ecological systems?
  - Under what conditions is utilization economically sustainable?
  - What are the life cycle impacts of utilization on energy use and GHG emissions?



## Guidelines / Sidebars

- Temporal Scale: 20-50 years
- Spatial Scale: 1000-10,000 acres
- Feed Stock for Transportation Biofuels
- Examine a Range of Prescriptions
- Public and Private Land Cases
- Field Data Must Drive LCA Models



## Research Objectives

1. **The impacts of wildfire** on the sustainability of forest ecosystems **with and without treatment**, including the effectiveness of treatments in reducing adverse impacts.
2. Review and analysis of the **impacts of forest fuel treatments** on soils and nutrient cycling, watershed function, wildlife and biodiversity.
3. Collecting and documenting relevant **information on sustainability of sites to be visited** this summer **in the proposed field tours**, and post-tour analysis.
4. **Life Cycle Analysis (LCA)** of both untreated forest stands and treated landscapes, and of alternative fuel conversion and biomass utilization pathways.
5. **Benchmarking** state and federal management guidelines with 3<sup>rd</sup> party forest **certification systems** and protocols.
6. **Economics of forest biomass utilization including:**
  - Site-specific analyses of feedstock acquisition, supply, and facility location.
  - Market analysis of feedstock allocation across competing uses.
  - Landowner behavior under proposed carbon crediting initiatives.
7. **Developing detailed case studies of 4-6 study sites.**



## Funding Structure

1. **The impacts of recent fires** on the sustainability of forest ecosystems with and without treatment.

**\$240,000**

2. **Review and analysis of forest biomass utilization sustainability**, including impacts on soils, watersheds, habitat and biodiversity.

**\$565,000**

3. **Field Tour Technical Support** **\$50,000**

4. **Life Cycle Analysis (LCA)** of untreated and treated landscapes, including biofuels and co-products, expected emissions, sequestration, and energy use. **\$500,000**

5. Benchmarking public management guidelines with private certification systems .

**\$115,000**

6. **Feedstock supply and economics.** **\$240,000**

7. **Case studies of forest biomass utilization and forest fuel reduction.**

**\$250,000**

**Total**

**\$1,960,000**

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
1	<b>Wildfire Impacts:</b> -treatment and utilization effects	Quantifying impacts of severe wildfire forest health in adjacent treated and untreated stands, including tree mortality and survival, soil health, post-fire beetle attack rates, seedling densities, hardwood re-sprouting response, understory diversity, and soil litter. Analysis of recent CA fires.	May, 2010-November,2012	<b>\$120,000</b>
1,2	<b>Prescription design</b>	Watershed-scale design of fuel treatments for carbon conservation, wildlife habitat and ecological impacts.	April, 2010-Fall, 2010	<b>\$120,000</b>
2	<b>Treatment Impacts:</b> Carbon	Quantifying carbon storage and carbon mass balances on treated and untreated forests from recent CA wildfires, using actual field data from recent fires; stand- and project-scale analyses of impacts of utilization.	May, 2010-October, 2011	<b>\$145,000</b>
2	<b>Treatment Impacts: private</b>	Private forest land treatment impacts on wildlife, nutrient cycling, soil health, biodiversity, etc.; analysis of field data.		<b>\$150,000</b>
2	Wildlife habitat impacts	Wildlife habitat and biodiversity impacts of fuel reduction treatments	2010-2013	120000
2	<b>Treatment:</b> soils, watershed	Review of literature and/or data on treatment impacts on soils and water resources		<b>\$150,000</b>
3	<b>Field Tour Tech Support</b>	Collecting and documenting relevant information on sustainability of sites to be visited this summer in the proposed field tours, and post-tour analysis.	April, 2010—September, 2010	<b>\$50,000</b>
4	<b>Life Cycle Analyses</b>	forest utilization alternatives		
4	Expected fire impacts	Develop expected wildfire distributions and impacts—with and without fuel reduction/forest health treatments.	May, 2010- Fall, 2010	<b>\$75,000</b>
4	LCA of pathways	Risk-Based Life Cycle Analysis of Forest Utilization Pathways	4/10-02/11	<b>\$150,000</b>
4		LC analysis of restoration and no treatment alternatives	4/10-12/10	<b>\$175,000</b>
4	Alternative fuel pathways	Extension of LCA work for utilization for ethanol, bio-methane, and other fuels, from alternative technological pathways—hydro-pyrolysis, gasification, hydrolysis, etc.		<b>\$100,000</b>
5	<b>Benchmark certification standards</b>	Review of existing studies comparing public forest practice regulations with certification programs. Identify gaps or study needs.	May, 2010—September, 2010	<b>\$35,000</b>
5		Comparison and contrast of existing state and federal forest practice regulations and planning procedures with third party forest sustainability certification programs.		<b>\$80,000</b>
6	<b>Feedstock Supply and Economics</b>			
6	Site analyses	Bio_Sum analyses of potential facility sites, including: Acquisition costs by prescription specs and harvest technologies		<b>\$200,000</b>
6		Potential location and scale of biomass facilities Aggregate local feedstock supply		
6	Landowner behavior	Review and synthesis of literature on landowner response to carbon credit and other carbon incentive programs, including methodologies, data needs, and critical assumptions		<b>\$40,000</b>
7	Case Studies	Develop case studies from existing study sites and data. Developing more detailed case studies of one or more sites.		<b>\$250,000</b>
<b>Totals</b>				<b>\$1,960,000</b>



# CALIFORNIA ENERGY COMMISSION

**1. The impacts of recent fires** on the sustainability of forest ecosystems with and without treatment

**2. Review and analysis of forest biomass utilization sustainability**, including impacts on soils, watershed function, habitat, and biodiversity and other sustainability dimensions.

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
1	<b>Wildfire Impacts:</b> - treatment and utilization effects	Quantifying impacts of severe wildfire forest health in adjacent treated and untreated stands, including tree mortality and survival, soil health, post-fire beetle attack rates, seedling densities, hardwood re-sprouting response, understory diversity, and soil litter. Analysis of recent CA fires.	May, 2010- November, 2012	\$120,000
1,2	<b>Prescription design</b>	Watershed-scale design of fuel treatments for carbon conservation, wildlife habitat and ecological impacts.	April, 2010-Fall, 2010	\$120,000
			Sub-Total	<b>\$240,000</b>



**2. Review and analysis of forest biomass utilization sustainability**, including impacts on soils, watershed function, habitat, biodiversity and other sustainability dimensions.

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
2	<b>Treatment Impacts: Carbon</b>	Quantifying carbon storage and carbon mass balances on treated and untreated forests from recent CA wildfires, using actual field data from recent fires; stand- and project-scale analyses of impacts of utilization.	May, 2010-October, 2011	<b>\$145,000</b>
2	<b>Treatment Impacts: private</b>	Private forest land treatment impacts on wildlife, nutrient cycling, soil health, biodiversity, etc.; analysis of field data.		<b>\$150,000</b>
2	Wildlife habitat impacts	Wildlife habitat and biodiversity impacts of fuel reduction treatments	2010-2013	<b>120000</b>
2	<b>Treatment: soils, watershed</b>	Review of literature and/or data on treatment impacts on soils and water resources		<b>\$150,000</b>
			Sub-Total	<b>\$565,000</b>



**3. . Field Tour Technical Support**

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
3	<b>Field Tour Tech Support</b>	Collecting and documenting relevant information on sustainability of sites to be visited this summer in the proposed field tours, and post-tour analysis.	April, 2010— September, 2010	<b>\$50,000</b>
			Sub-Total	<b>\$50,000</b>



**4. Life Cycle Analysis (LCA)** of untreated and treated landscapes, and utilization pathways, including biofuels and co-products, expected emissions, sequestration, and energy use.

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
4	<b>Life Cycle Analyses</b>			
4	Expected fire impacts	Develop expected wildfire distributions and impacts—with and without fuel reduction/forest health treatments.	May, 2010-Fall, 2010	<b>\$75,000</b>
4	LCA of pathways	Risk-Based Life Cycle Analysis of Forest Utilization Pathways	4/10-02/11	<b>\$150,000</b>
4	Alternative fuel pathways	LC analysis of restoration and no treatment alternatives	4/10-12/10	<b>\$175,000</b>
4		Extension of LCA work for utilization for ethanol, bio-methane, and other fuels, from alternative technological pathways—hydro-pyrolysis, gasification, hydrolysis, etc.		<b>\$100,000</b>
			Sub-Total	<b>\$500,000</b>



**5. Benchmarking public management guidelines with private certification systems.**

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
5	<b>Benchmark certification standards</b>	Review of existing studies comparing public forest practice regulations with certification programs. Identify gaps or study needs.	May, 2010—September, 2010	<b>\$35,000</b>
5		Comparison and contrast of existing state and federal forest practice regulations and planning procedures with third party forest sustainability certification programs.		<b>\$80,000</b>
			Sub-Total	<b>\$115,000</b>



**6. Feedstock supply and economics**

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
6	<b>Feedstock Supply and Economics</b>			
	Site analyses	Bio_Sum analyses of potential facility sites, including: <ul style="list-style-type: none"> <li>• Acquisition costs by prescription specifications and harvest technologies</li> <li>• Potential location and scale of biomass facilities</li> <li>• Aggregate local feedstock supply</li> </ul>		<b>\$200,000</b>
6	Landowner behavior	Review and synthesis of literature on landowner response to carbon credit and other carbon incentive programs, including methodologies, data needs, and critical assumptions		<b>\$40,000</b>
6				
			Sub-Total	<b>\$240,000</b>



**7. Case studies of forest biomass utilization and forest fuel reduction**

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
7	Case Studies	Develop case studies from existing study sites and field data locations.		\$250,000
			Sub-Total	\$250,000



## Other Potential Projects

Research Objective Number	Research Objective	Summary of Project	Timeline
<b>Other</b>	Long-term or other funding		
2	Carbon storage and large trees	Carbon storage metrics and dynamics. Factors affecting large tree survival after treatment	09/10-06/12 06/10-06/12
6	Policy Demand	Estimating aggregate policy demands for biomass energy.	
2	Treatment Impacts: spatial and temporal scales	landscape- and decadal-scale impacts: wildlife, nutrient cycling, watershed function, and fire behavior--multiple studies	
	Landowner behavior	Microeconomic analysis of landowner behavior under proposed state and federal policy incentives and barriers, including carbon credits and offsets from state and federal programs	
7	Trends in wildfire size and impacts.	Trends in the scale and severity of wildfire—distribution of acreage by size and severity classes, and of patch sizes by severity class.	
6	Feedstock allocation scenarios at landscape scales	Analysis of economic impacts-alternative feedstock uses: Market impacts of feedstock allocations across uses—CA or multi-regional?	
7	trends in forest tree mortality	Multi-region trends in forest tree mortality from drought, insects, and diseases.	

Research Objective Number	Research Objective	Summary of Project	Timeline	2009-2010 Budget
1	<b>Wildfire Impacts:</b> -treatment and utilization effects	Quantifying impacts of severe wildfire forest health in adjacent treated and untreated stands, including tree mortality and survival, soil health, post-fire beetle attack rates, seedling densities, hardwood re-sprouting response, understory diversity, and soil litter. Analysis of recent CA fires.	May, 2010-November,2012	<b>\$120,000</b>
1,2	<b>Prescription design</b>	Watershed-scale design of fuel treatments for carbon conservation, wildlife habitat and ecological impacts.	April, 2010-Fall, 2010	<b>\$120,000</b>
2	<b>Treatment Impacts:</b> Carbon	Quantifying carbon storage and carbon mass balances on treated and untreated forests from recent CA wildfires, using actual field data from recent fires; stand- and project-scale analyses of impacts of utilization.	May, 2010-October, 2011	<b>\$145,000</b>
2	<b>Treatment Impacts: private</b>	Private forest land treatment impacts on wildlife, nutrient cycling, soil health, biodiversity, etc.; analysis of field data.		<b>\$150,000</b>
2	Wildlife habitat impacts	Wildlife habitat and biodiversity impacts of fuel reduction treatments	2010-2013	120000
2	<b>Treatment:</b> soils, watershed	Review of literature and/or data on treatment impacts on soils and water resources		<b>\$150,000</b>
3	<b>Field Tour Tech Support</b>	Collecting and documenting relevant information on sustainability of sites to be visited this summer in the proposed field tours, and post-tour analysis.	April, 2010—September, 2010	<b>\$50,000</b>
4	<b>Life Cycle Analyses</b>	forest utilization alternatives		
4	Expected fire impacts	Develop expected wildfire distributions and impacts—with and without fuel reduction/forest health treatments.	May, 2010- Fall, 2010	<b>\$75,000</b>
4	LCA of pathways	Risk-Based Life Cycle Analysis of Forest Utilization Pathways	4/10-02/11	<b>\$150,000</b>
4		LC analysis of restoration and no treatment alternatives	4/10-12/10	<b>\$175,000</b>
4	Alternative fuel pathways	Extension of LCA work for utilization for ethanol, bio-methane, and other fuels, from alternative technological pathways—hydro-pyrolysis, gasification, hydrolysis, etc.		<b>\$100,000</b>
5	<b>Benchmark certification standards</b>	Review of existing studies comparing public forest practice regulations with certification programs. Identify gaps or study needs.	May, 2010—September, 2010	<b>\$35,000</b>
5		Comparison and contrast of existing state and federal forest practice regulations and planning procedures with third party forest sustainability certification programs.		<b>\$80,000</b>
6	<b>Feedstock Supply and Economics</b>			
6	Site analyses	Bio_Sum analyses of potential facility sites, including: Acquisition costs by prescription specs and harvest technologies		<b>\$200,000</b>
6		Potential location and scale of biomass facilities Aggregate local feedstock supply		
6	Landowner behavior	Review and synthesis of literature on landowner response to carbon credit and other carbon incentive programs, including methodologies, data needs, and critical assumptions		<b>\$40,000</b>
7	Case Studies	Develop case studies from existing study sites and data. Developing more detailed case studies of one or more sites.		<b>\$250,000</b>
<b>Totals</b>				<b>\$1,960,000</b>



## Site Selection

### Evaluate candidate sites:

- Data breadth /Data length
- Data formatting
- Permitting/social license
- Treatment schedule

Select Sites

Develop case study profiles

## Field Data/Studies

**Direct Treatment Effects:**  
Wildlife/Biodiversity Soils/  
nutrient cycling Watershed  
/hydrology Forest Health  
Carbon storage and emissions

**Indirect Effects:** Fire  
Impacts on ecological  
dimensions of  
sustainability with and  
without treatment

**Feedstock Economics:**  
Forest Inventory  
Prescription designs  
Geographic site data  
Operations cost data  
Product prices/output

**Fuel Conversion  
Technologies:** conversion rates  
process efficiencies fuel  
characteristics emissions  
profiles

## Scenario Modeling

**Ecological Impacts**

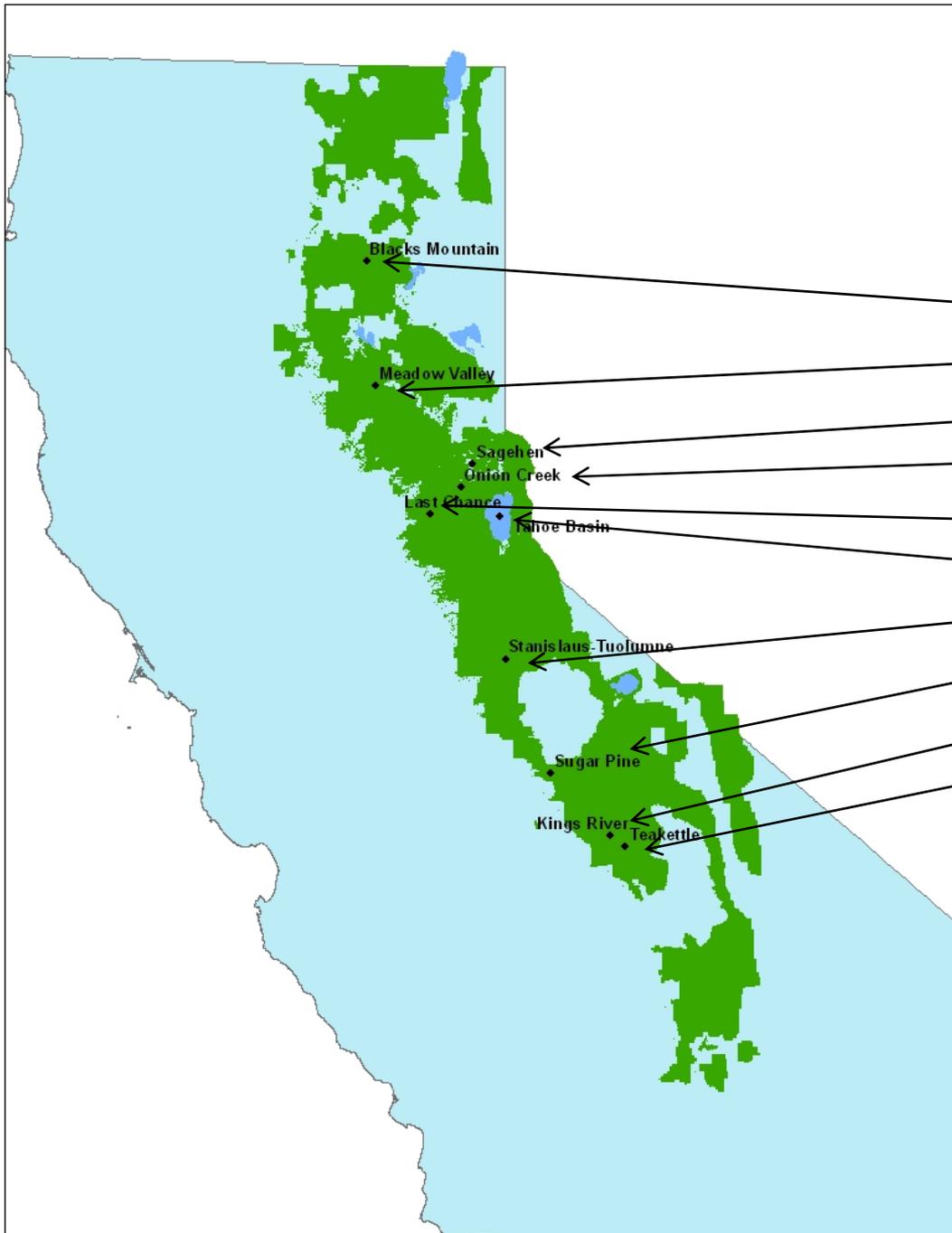
**Life Cycle Analysis:**  
Management alternatives

**Life Cycle Analysis:**  
Fuel conversion pathways

**Supply Economics:**  
Feedstock Acquisition Costs  
Fuels Facility Siting  
Project feedstock supplies

Case Studies

## Active Forest Research Sites on National Forest Lands



Blacks Mountain EF

Meadow Valley

Sagehen EF

Onion Creek EF

Last Chance (SNAMP)

Lake Tahoe Basin

Stanislaus-Tuolumne EF

Sugar Pine (SNAMP)

Kings River

Teakettle EF

**Potential Public Study Sites**