

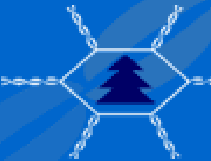
# Wood energy policies and recent developments in the OECD

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Forest Products Biotechnology  
University of British Columbia

UNECE / FAO Policy Forum:  
Opportunities and impacts of bioenergy policies and targets on the forest and other sectors

10 October 2007

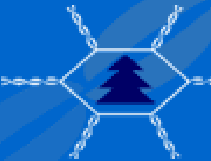
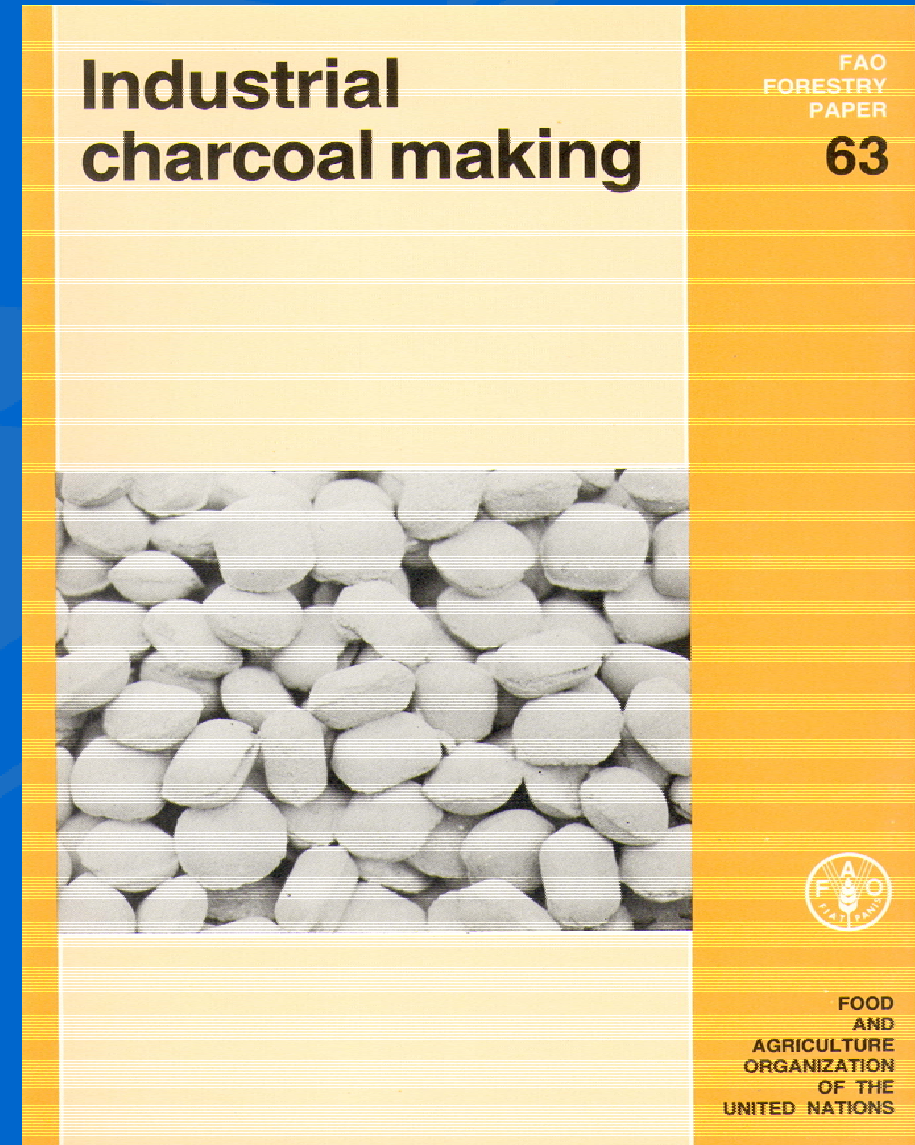


Forest Products Biotechnology at UBC

# Introduction

- Over 50% of forestry biomass harvested today is used for energy (FAO 2007)
- Recent reports prepared by the OECD, UNECE, IEA, FAO and others has informed the discussion tremendously
- New policies are changing the role of wood-to-bioenergy
- Research is still required, including development of better data describing biomass recovery from forests and trade opportunities for biomass and biofuels

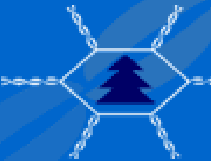
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# What is bioenergy?

- Energy derived from all biomass, including forests
  - Derived as heat
  - Transformed into electricity
  - Delivered to industrial, transportation sector via *biofuels*
- Wood energy is one component of total bioenergy
- May be produced and used on-site (either residential or industrial)
- May be produced for third-party sales
- A type of renewable energy (when produced sustainably)

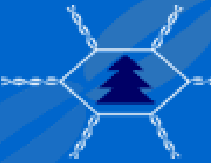
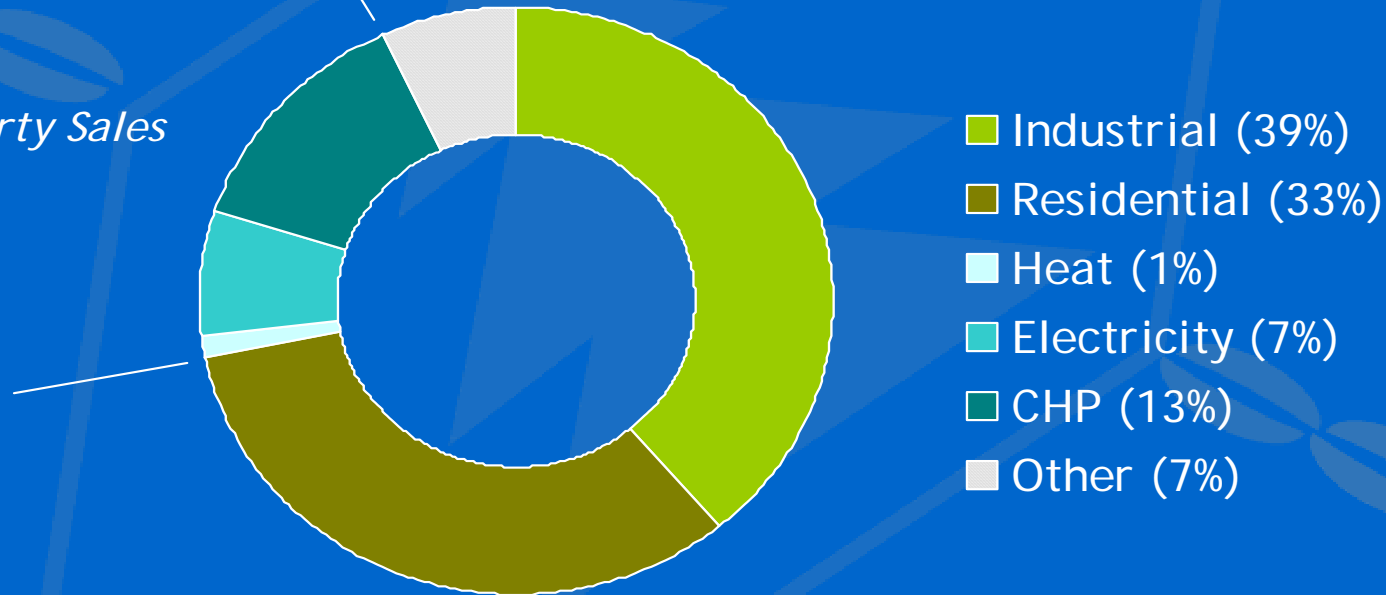
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# Bioenergy use (OECD)

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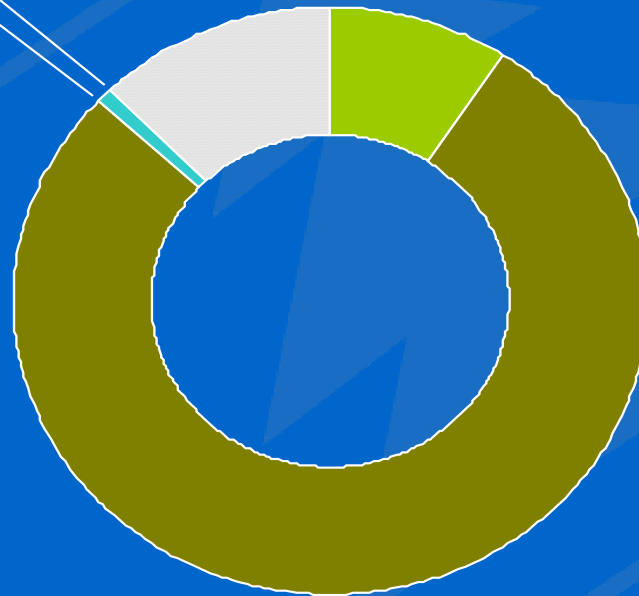
*3rd Party Sales*



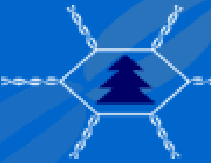
# Bioenergy use (non-OECD)

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*3rd Party Sales*



- Industrial (9%)
- Residential (77%)
- Heat (0%)
- Electricity (1%)
- CHP (0%)
- Other (12%)

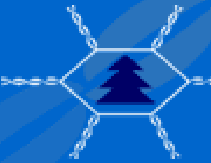


# Residential bioenergy

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## Residential bioenergy options:

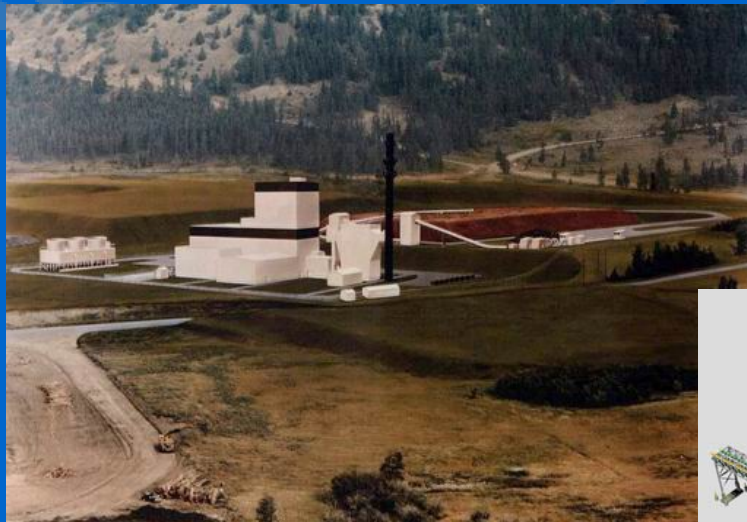
- Open fires
- Traditional wood stoves
- Charcoal
- Wood pellets





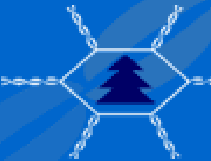
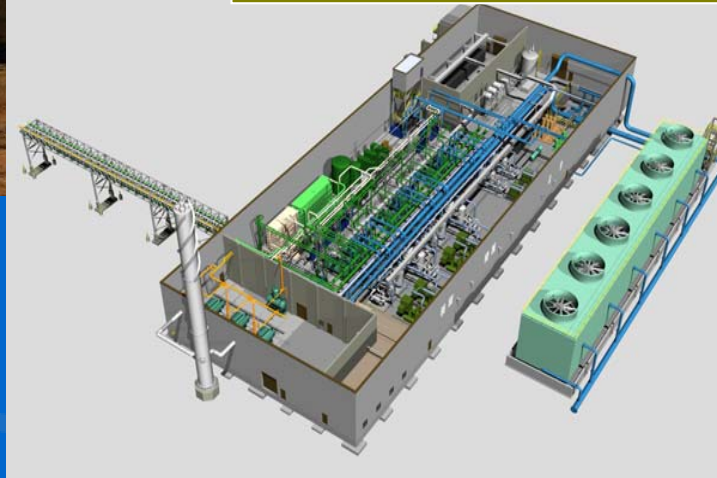
# Industrial bioenergy

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Industrial bioenergy options:

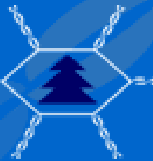
- Combined heat & power
- Power boilers
- Gasification
- CHP + Heat recovery systems



# What are biofuels?

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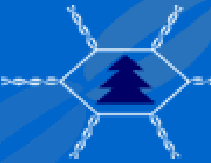
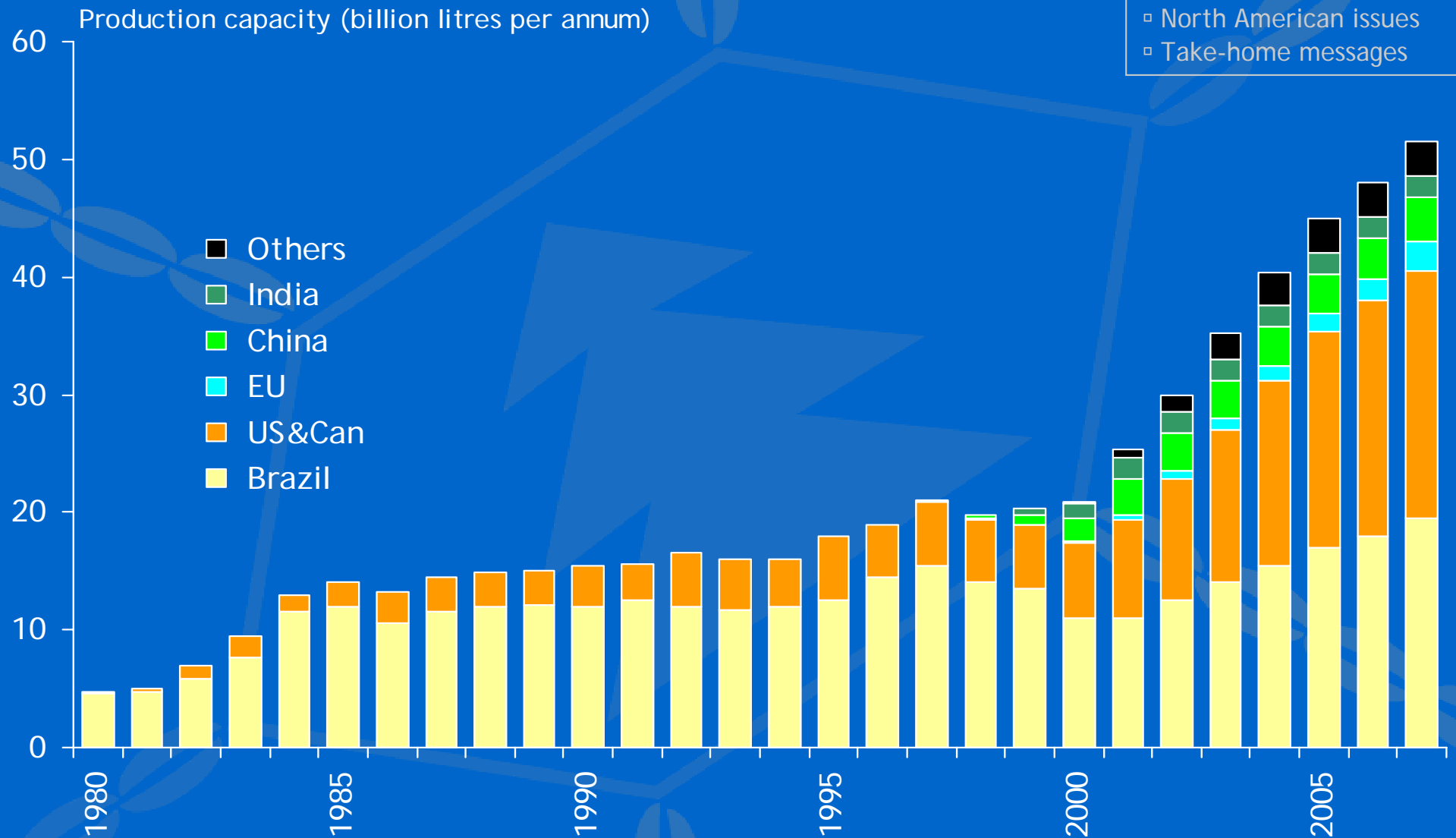
- Bioenergy feedstocks, usually in solid or liquid forms (i.e. wood pellets, bioethanol, biodiesel, etc.)
- Biofuels may be classified by biomass source:
  - Agrofuels (i.e. sugar, starch, vegetable oils)
  - Woodfuels (fuelwood, charcoal)
- Solid biofuels include wood pellets, charcoal, etc.
- Liquid biofuels may be classified by feedstock:
  - Food-based liquid biofuels (derived from foodstuffs)
  - Cellulosic liquid biofuels (derived from the cellulosic component of agrofuels and woodfuels)





# Bioethanol worldwide

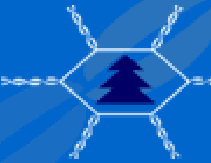
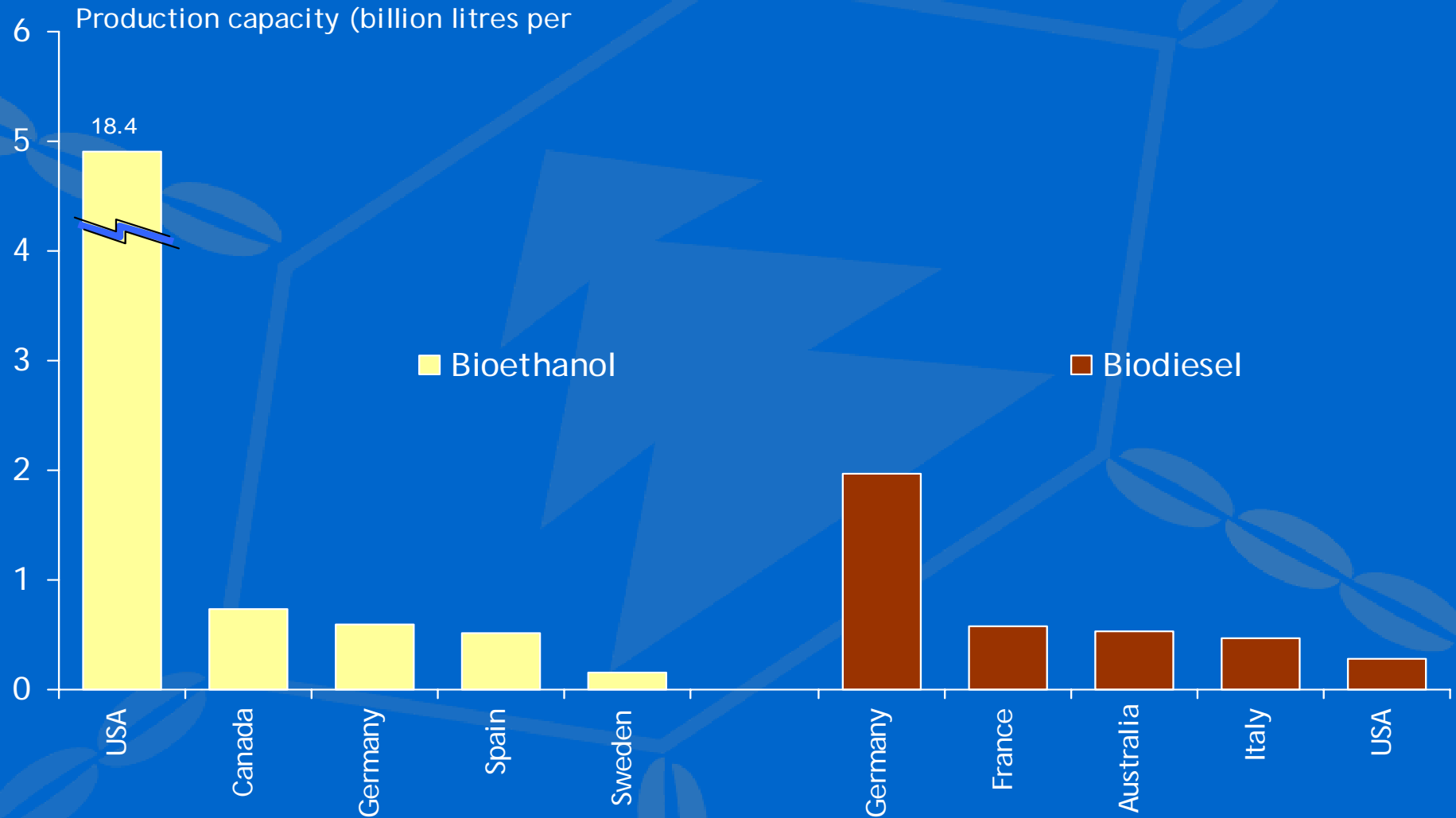
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# Biofuel producers (OECD)

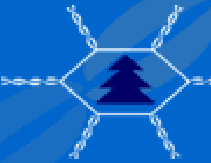
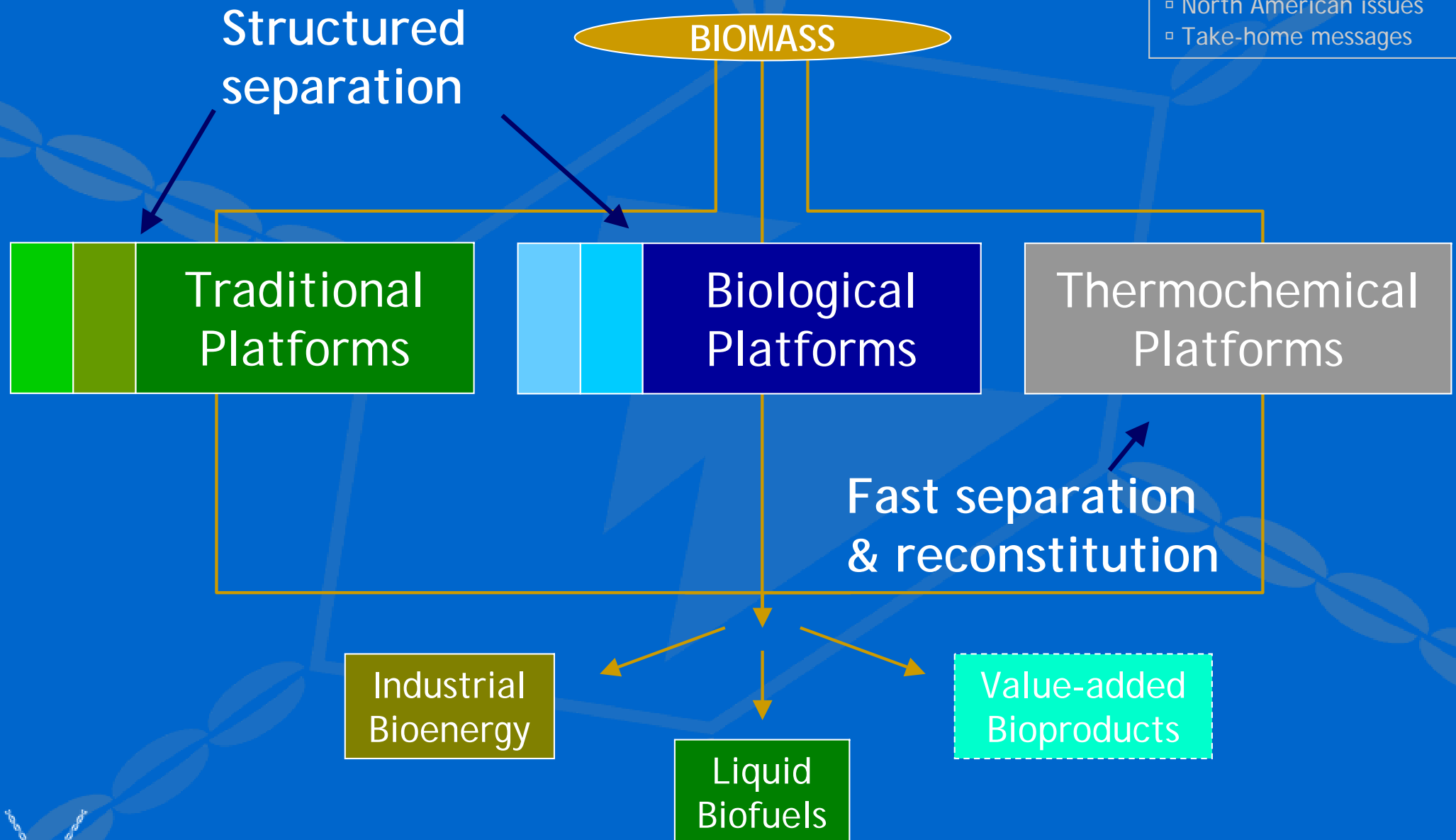
(bioethanol, biodiesel in 2006)

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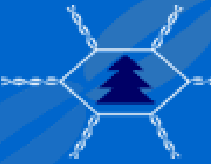
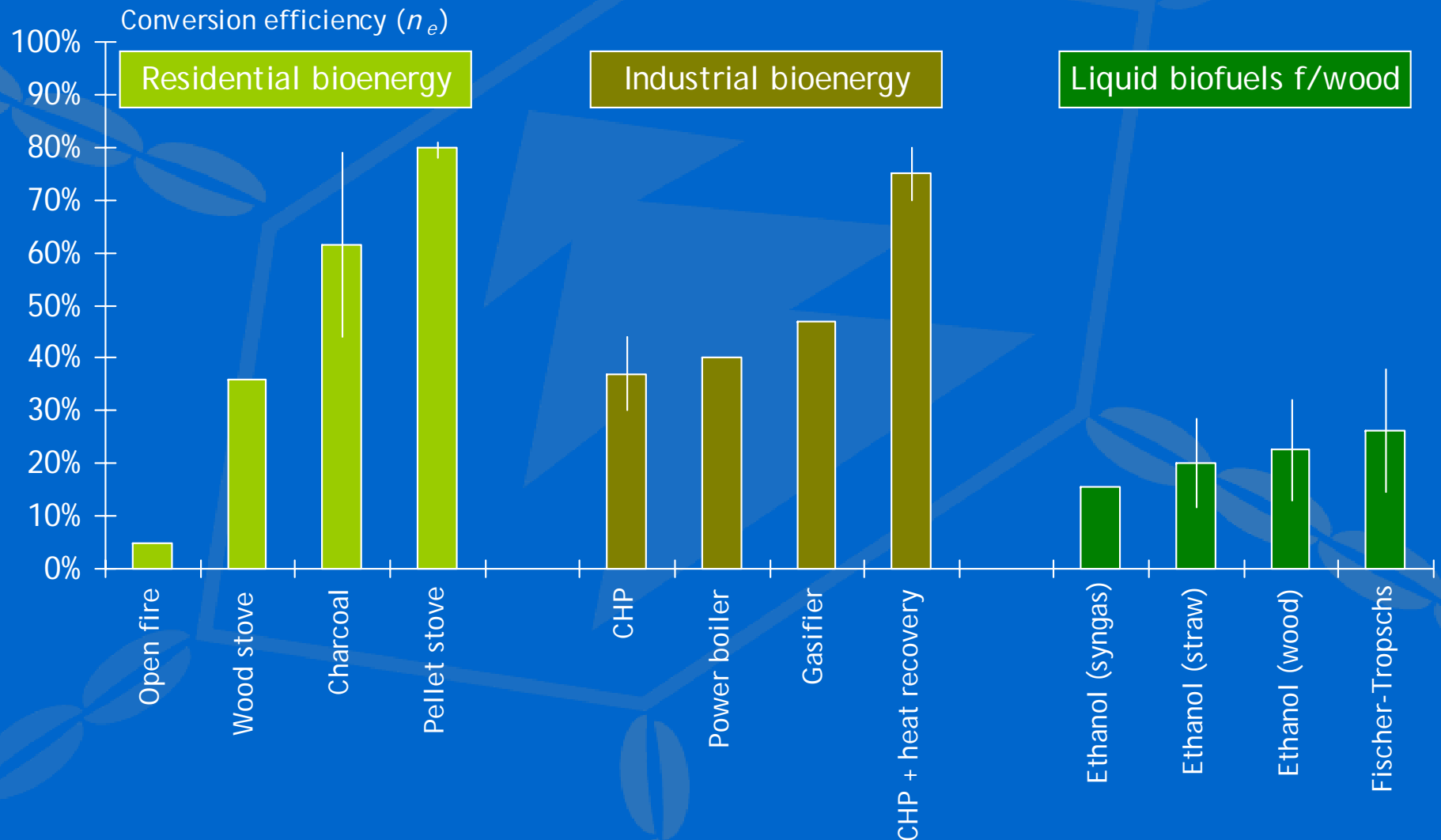
# Cellulosic platforms

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# Comparing efficiencies

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# Bioenergy policy tools

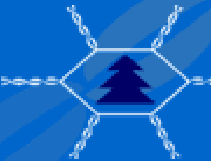
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## *Top-down, 'rigid' mechanisms*

- Feed-in tariffs  
*(set a specific price that utilities must pay to domestic producers of 'green' electricity)*
- Fixed price mechanisms  
*(premium or bonus paid above the normal rate directly to producers and/or distributors of 'green' energy)*
- Renewable energy obligation  
*(mandate the amount of renewable energy in an energy portfolio)*

## *Bottom-up mechanisms*

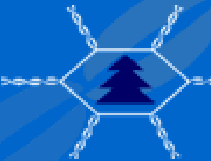
- Green certificates  
*(renewable electricity is sold at conventional prices, but consumers must purchase green certificates to cover a % of total electricity consumption)*
- Tax incentives, loan guarantees, grants



# Recent developments

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- European Union
- Four primary policies cover the European Union:
  - Energy efficiency in buildings and end-use applications (2 Directives)
  - Trade of GHG emissions throughout the EU (Directive 2003/87/EC)
  - Production of electricity from renewable sources (Directive 2001/77/EC)
  - Promotion of biofuels for transport (Directive 2003/30/EC)
- A Biomass Action Plan has also been developed (2005)
- A new Directive (2007) sets specific goals beyond 2012:
  - 20% target for renewable energy in 2020
  - 10% target for biofuels in 2020
  - Includes a sustainability scheme





# Recent developments

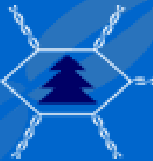
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## ■ United States

- 21 States have renewable portfolio standards
- Federal renewable fuel mandate
- Federal initiatives include a tax credit for biomass energy (but this does not yet apply to all forest bioenergy)
- Loan guarantees are also available under the Biomass energy and Alcohol Fuels Act of 1980

## ■ Canada

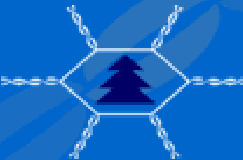
- A Renewable Energy Working Group has been formed by the Canadian Council of Energy Ministers and tasked with providing a framework to maximize renewable energy potential
- Some provinces (Ontario, Quebec, British Columbia) developing independent strategies that include bioenergy
- Ontario has recently introduced a feed-in tariff that applies to biomass
- A Renewable Energy Deployment Initiative ended in March 2007; a new ecoEnergy/ecoAction programme is being implemented



# Bioenergy policy issues

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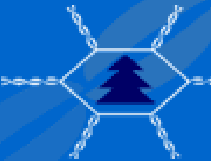
- ▶ Not clearly differentiated from renewable energy goals and policies in most cases
- ▶ Interdisciplinary nature of bioenergy requires multiple agencies to collaborate in traditional government systems  
*(i.e. natural resources, environment, energy, interior, transport, etc.)*
- ▶ Confusion exists over performance metrics  
*(i.e. economics, GHG emissions, energy balance, contribution to TPES, etc.)*
- ▶ Need for coordination between stakeholders



# Policy impacts (additional energy required)

- Introduction to bioenergy
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- North America
  - 301,700 TJ bioenergy, including 9,400 GWh biomass-to-electricity by 2010
  - 2,475,500 TJ biofuels by 2017
- Europe
  - 1,353,200 TJ bioenergy, including 17,600 GWh biomass-to-electricity by 2010
  - 573,000 TJ biofuels by 2010
- Other OECD
  - 179,900 TJ bioenergy, including 2,800 GWh biomass-to-electricity by 2010
  - 18,500 TJ biofuels by 2010\



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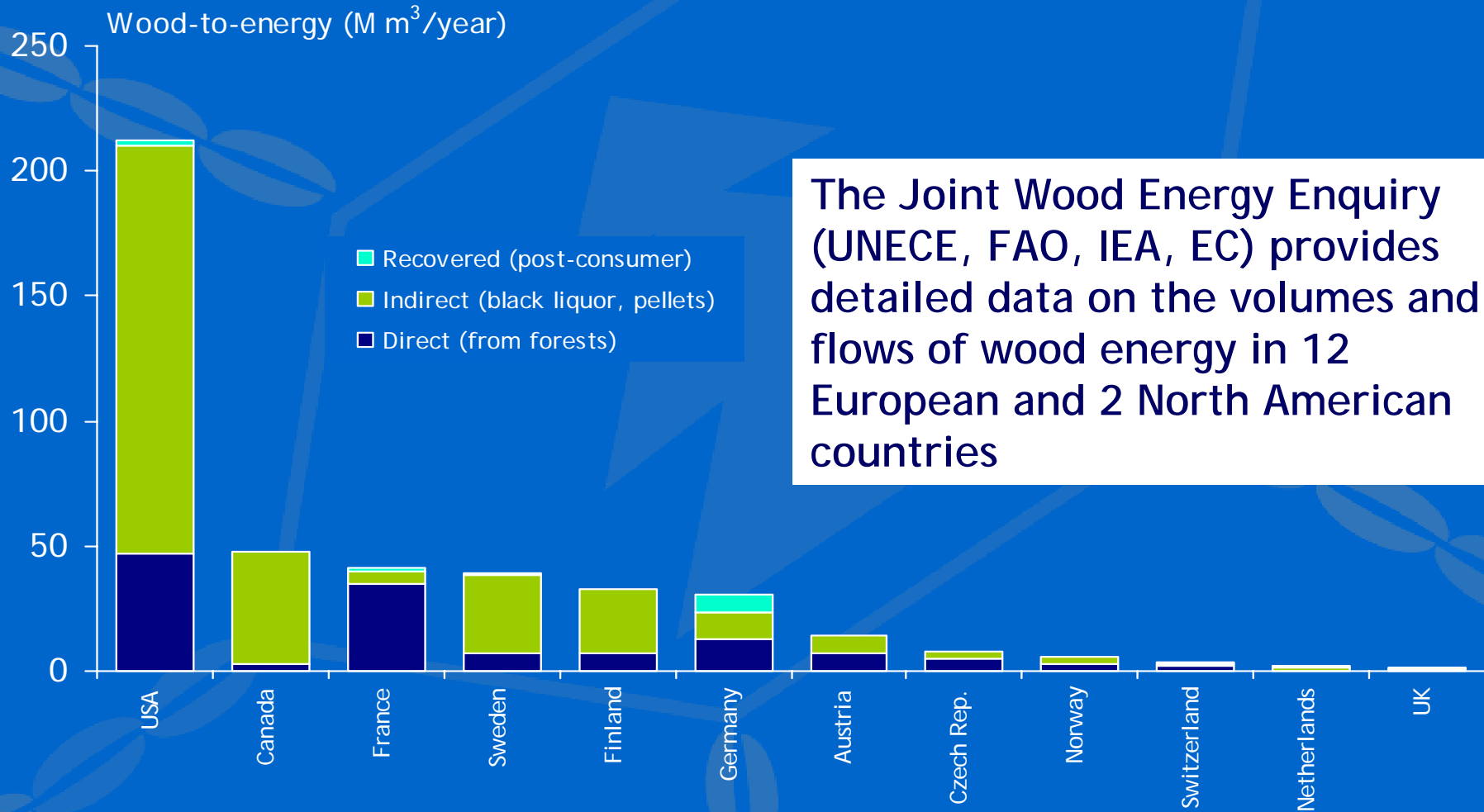
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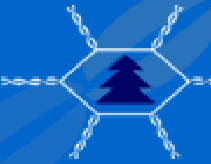
# Wood-to-energy (OECD)

## (Joint Wood Energy Enquiry)

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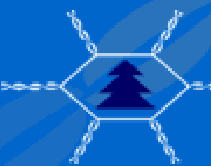
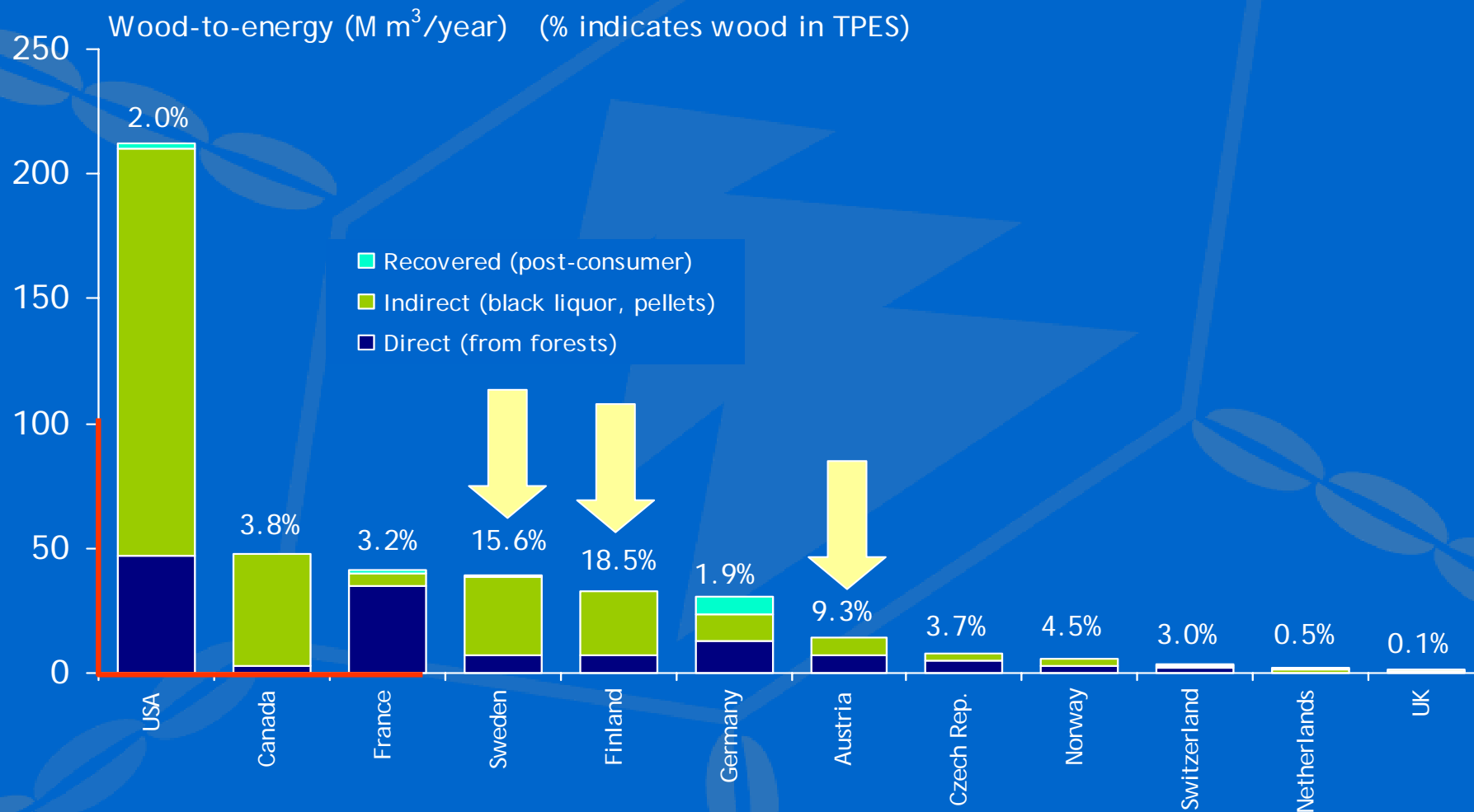


The Joint Wood Energy Enquiry (UNECE, FAO, IEA, EC) provides detailed data on the volumes and flows of wood energy in 12 European and 2 North American countries



# Wood-to-energy in TPES (Total Primary Energy Supply)

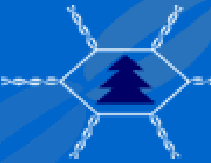
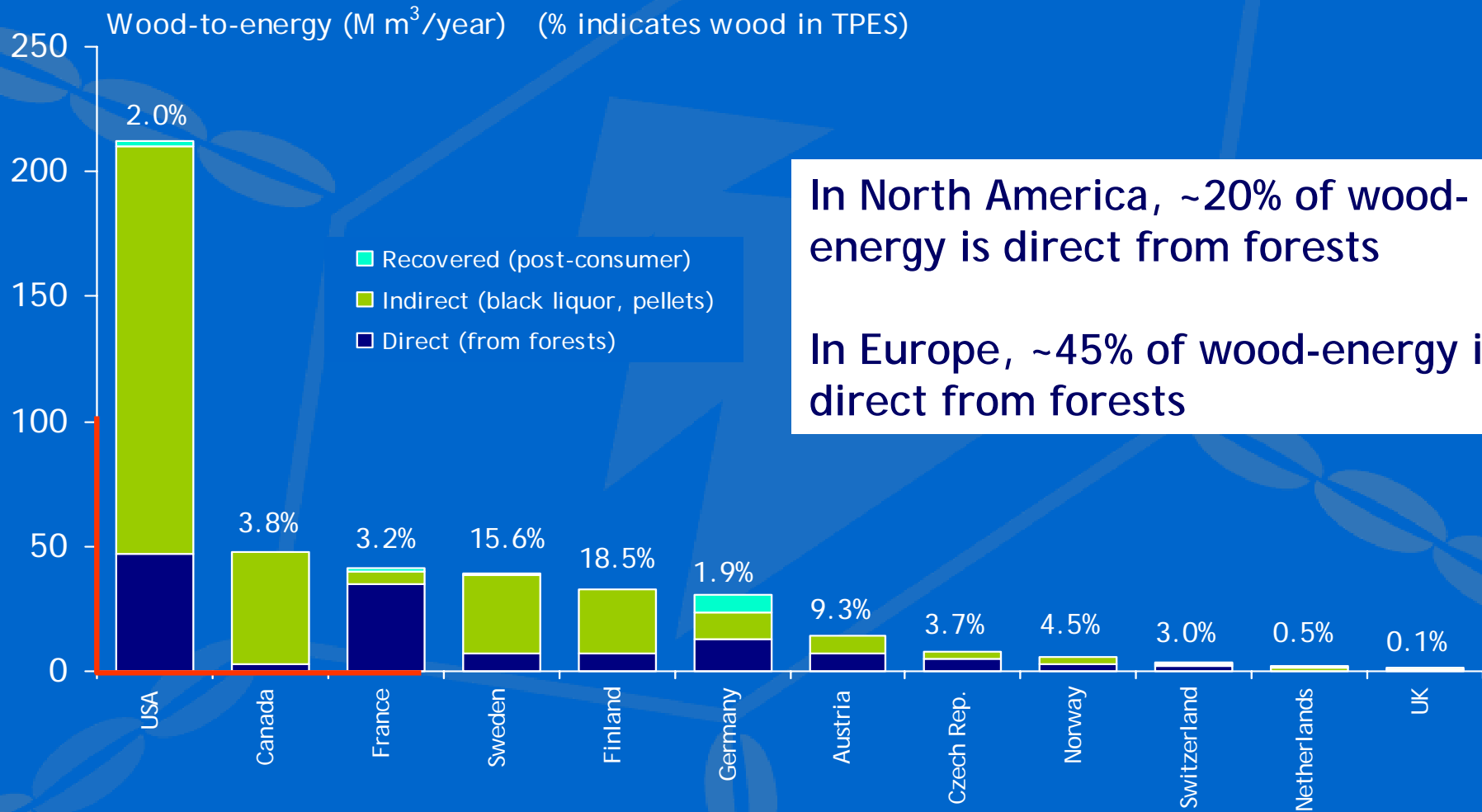
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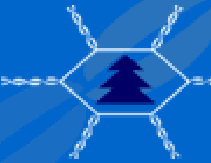
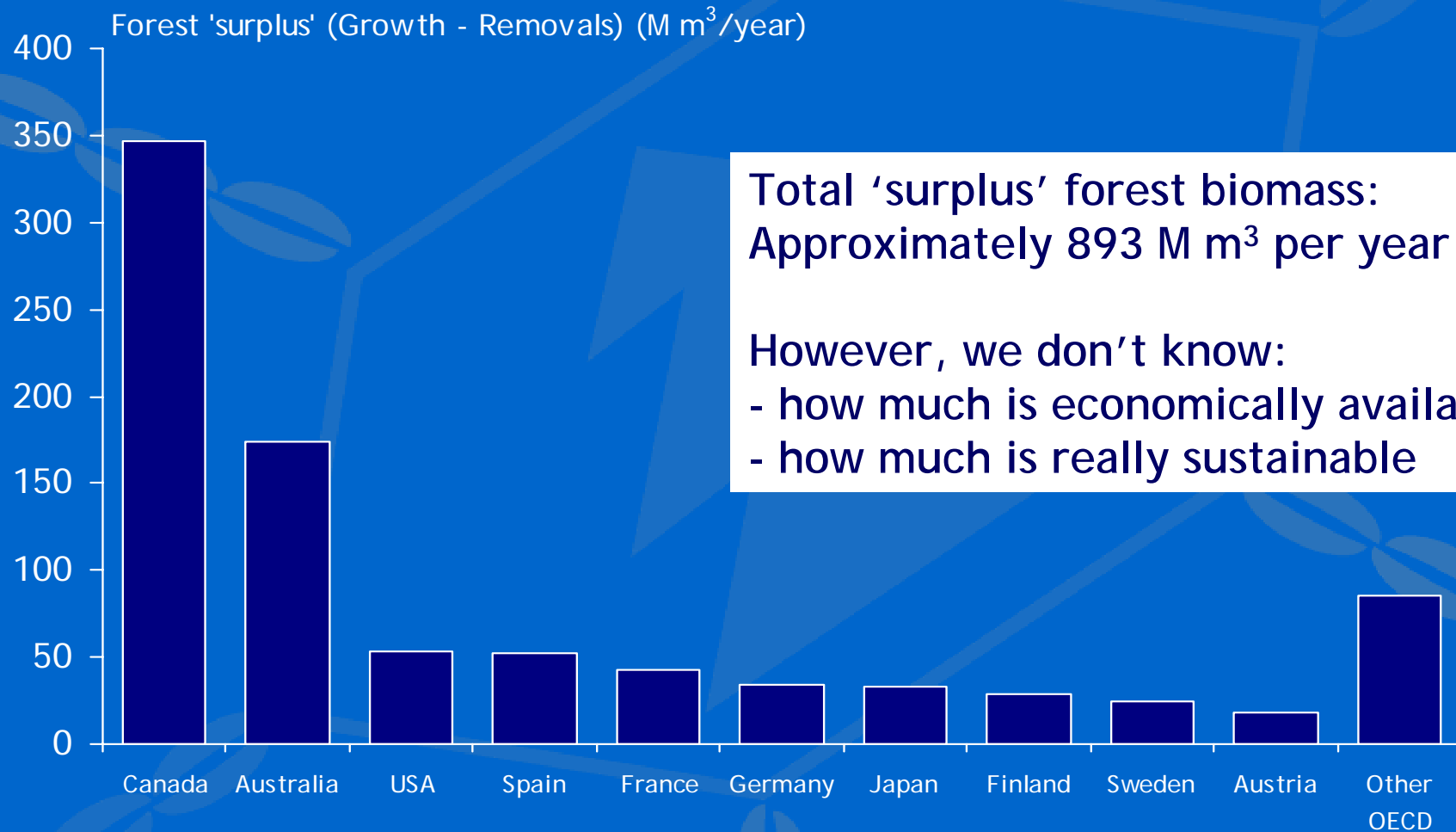
# Wood-to-energy

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# Forest biomass (OECD)

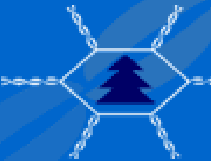
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# Policy impacts (additional energy required)

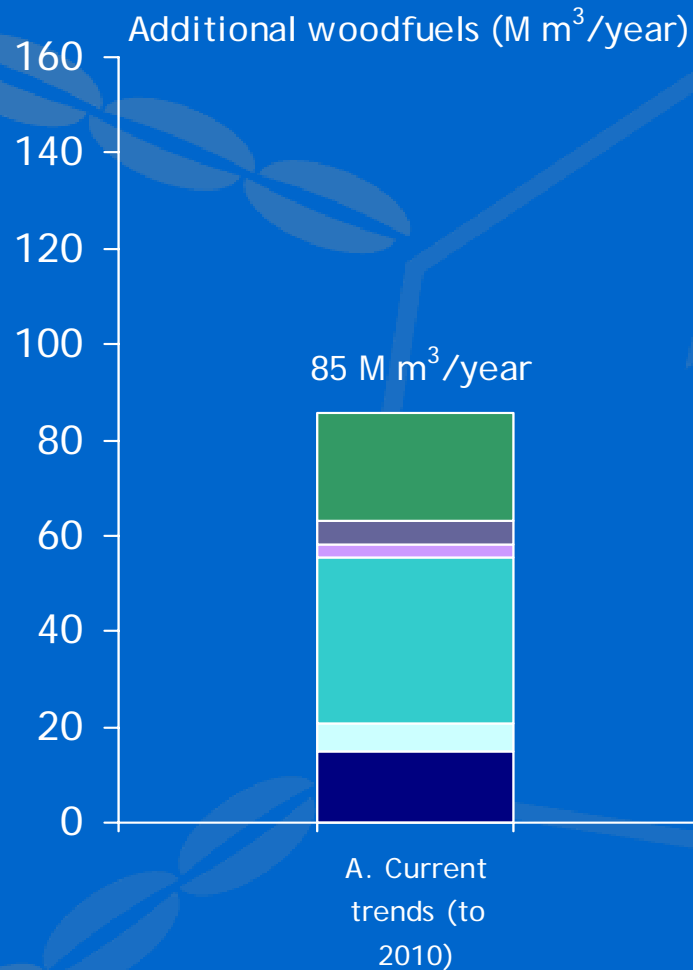
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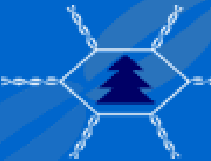
# Policy impacts - A (additional wood-to-energy)

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If current proportions of wood energy as a component of renewable energy persist, and current conversion technologies are not improved, approximately 85 million m<sup>3</sup> of additional forest biomass will be required to meet OECD policy goals by 2010

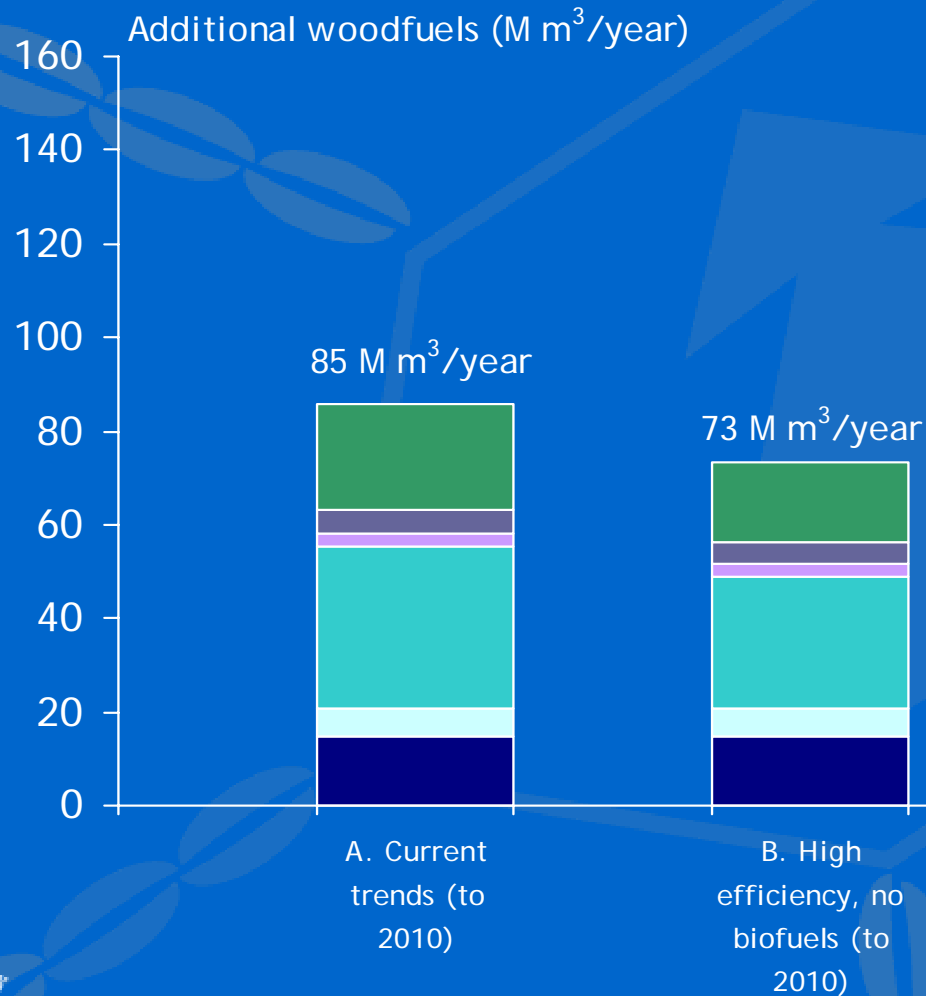
This is approximately 10% of the total forest 'surplus' across the OECD membership



# Policy impacts - B

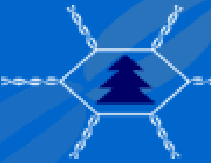
## (additional wood-to-energy)

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If new facilities employ state-of-the-art conversion technologies and all additional renewable energy requirements are met by wood energy, about 73 million m<sup>3</sup> of additional forest biomass would be required by 2010 - less than the current trends case.

This is approximately 8% of the total forest 'surplus' across the OECD membership



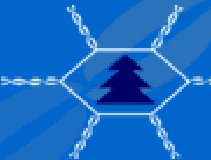
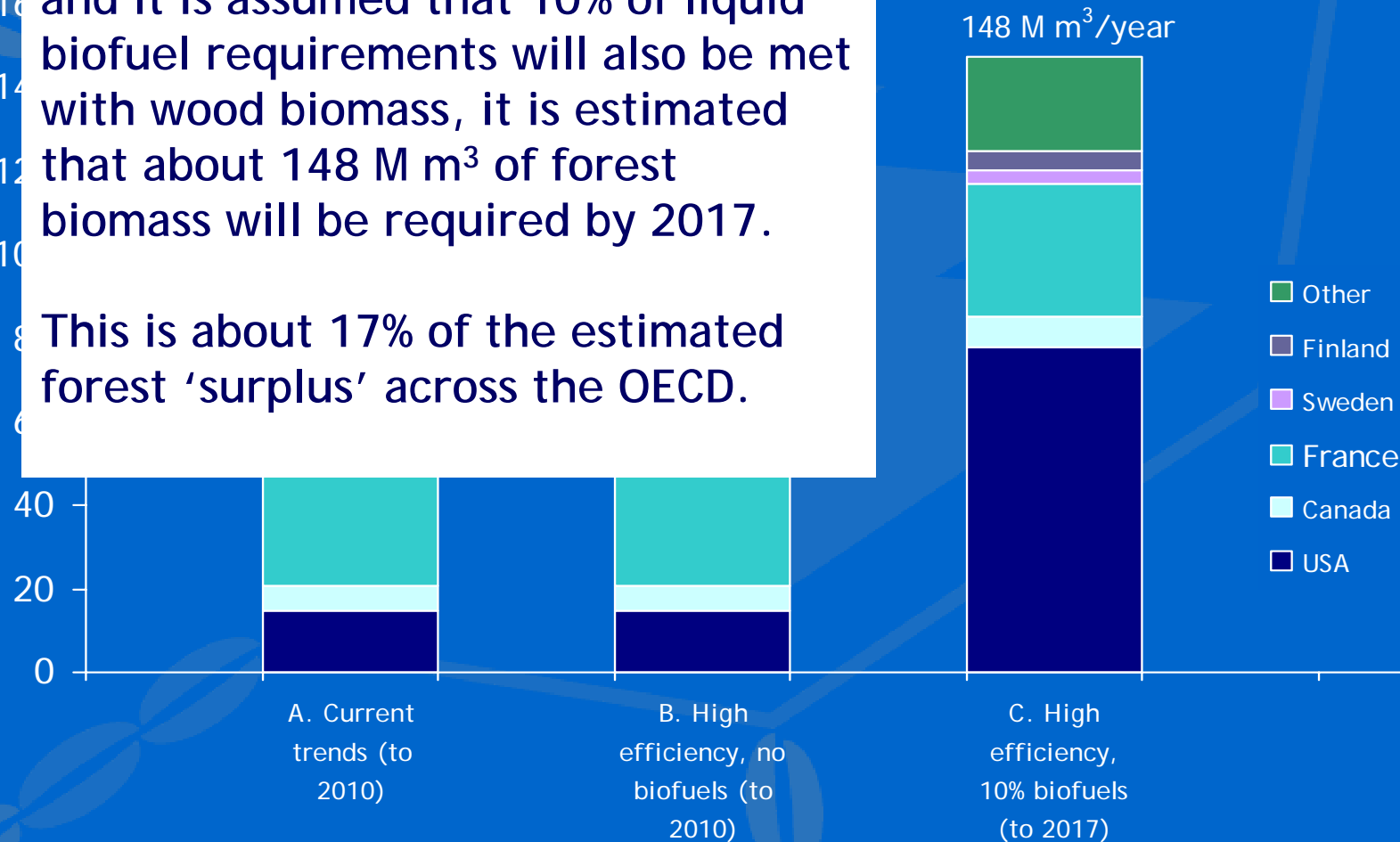
# Policy impacts - C

## (additional wood-to-energy)

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If the previous scenario is extended, and it is assumed that 10% of liquid biofuel requirements will also be met with wood biomass, it is estimated that about 148 M m<sup>3</sup> of forest biomass will be required by 2017.

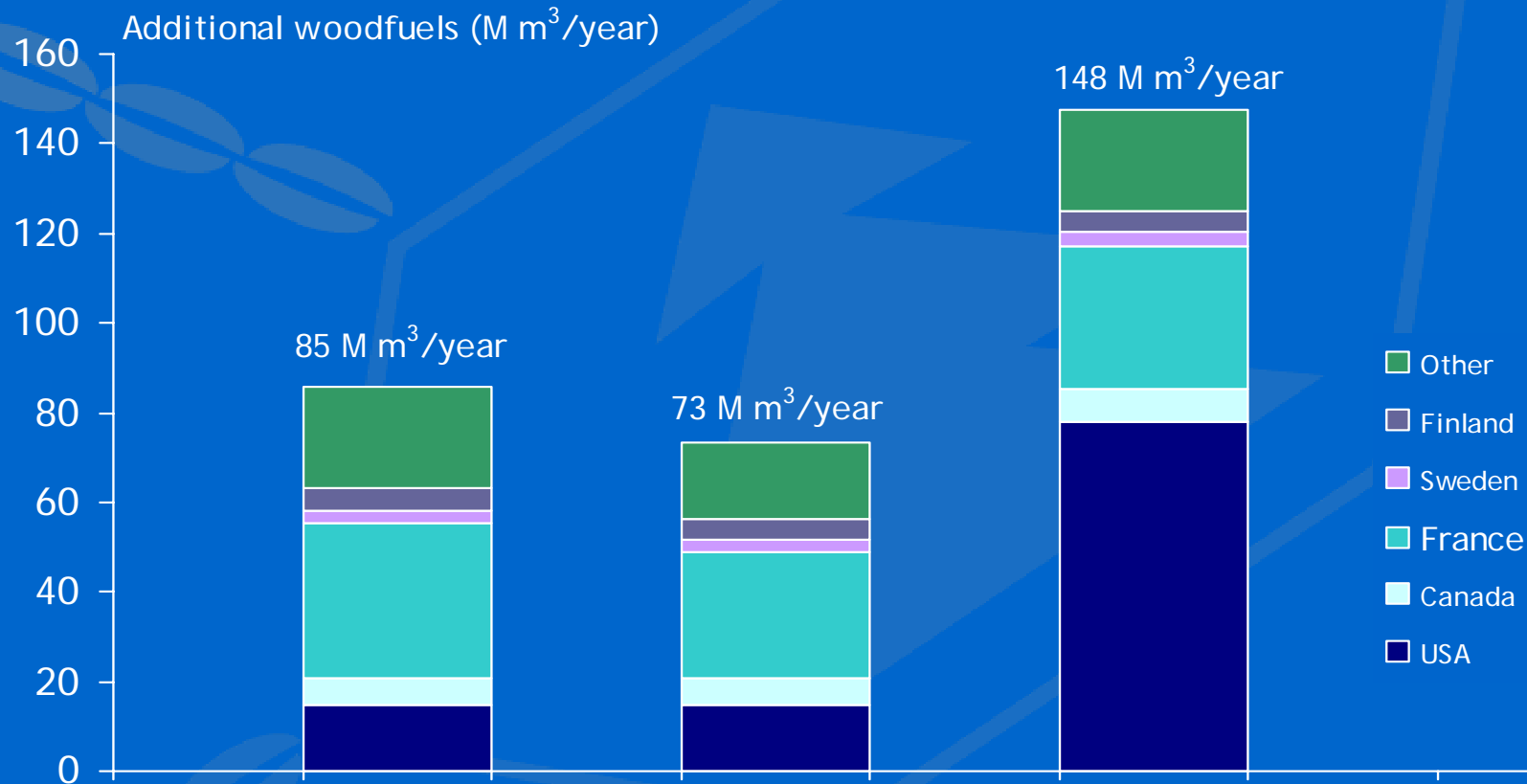
This is about 17% of the estimated forest 'surplus' across the OECD.



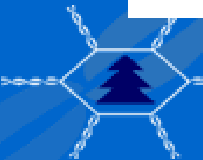


# Policy impacts (additional wood-to-energy)

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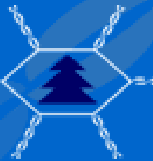
The largest forest biomass requirements are likely to be found in the US and France, followed by Canada, Finland and Sweden.



# Influence of bioenergy

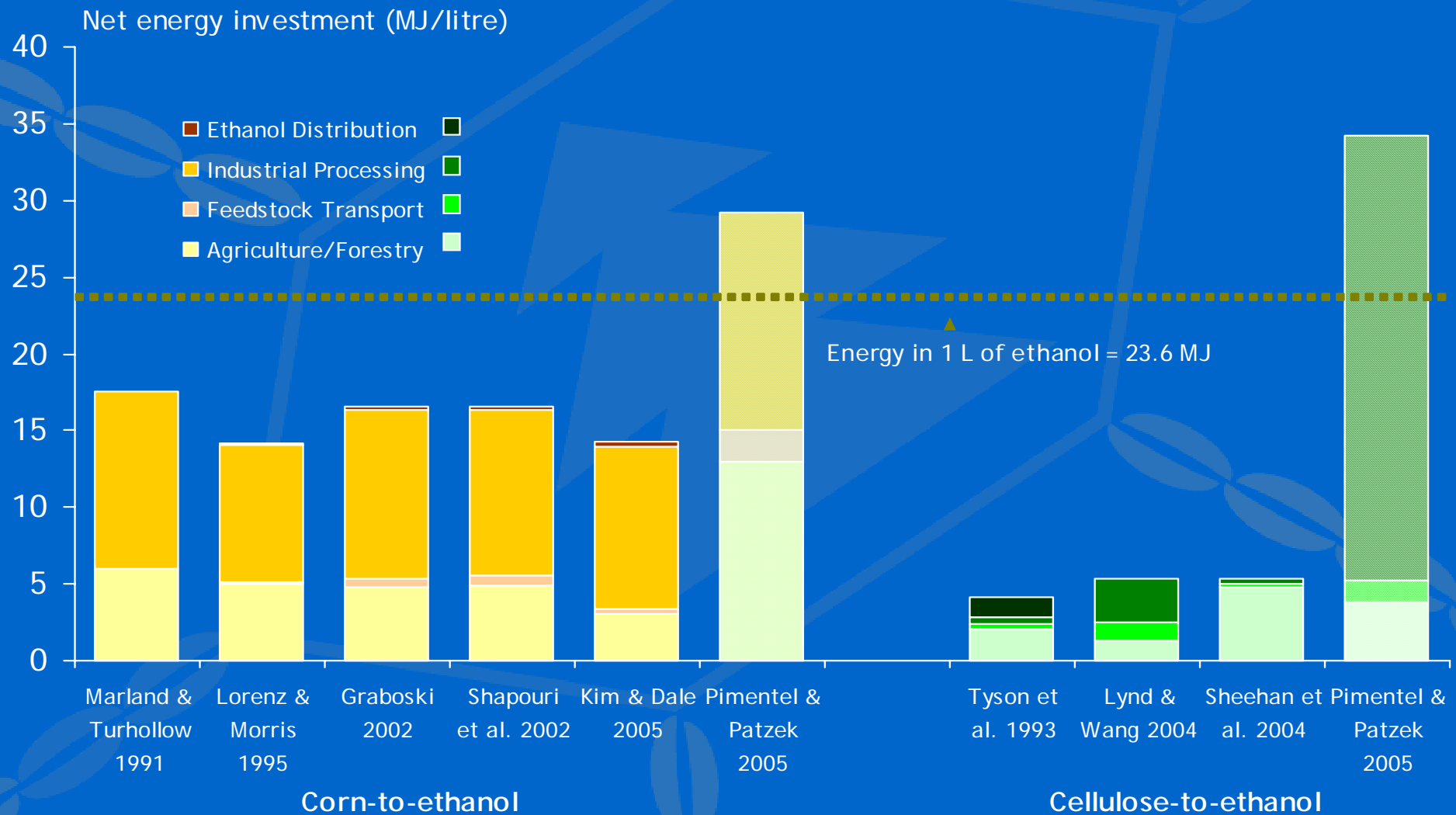
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- ▶ Expected increases in demand for forest biomass for bioenergy are relatively moderate across the OECD
- ▶ However, the demand for forest biomass could increase substantially with even a moderate increase in cellulosic biofuels
- ▶ The impacts of food-based vs. wood-based biofuels needs to be explored further
- ▶ Three big issues: energy balance, carbon balance, and food-vs.-fuel issues



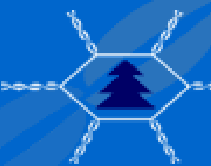
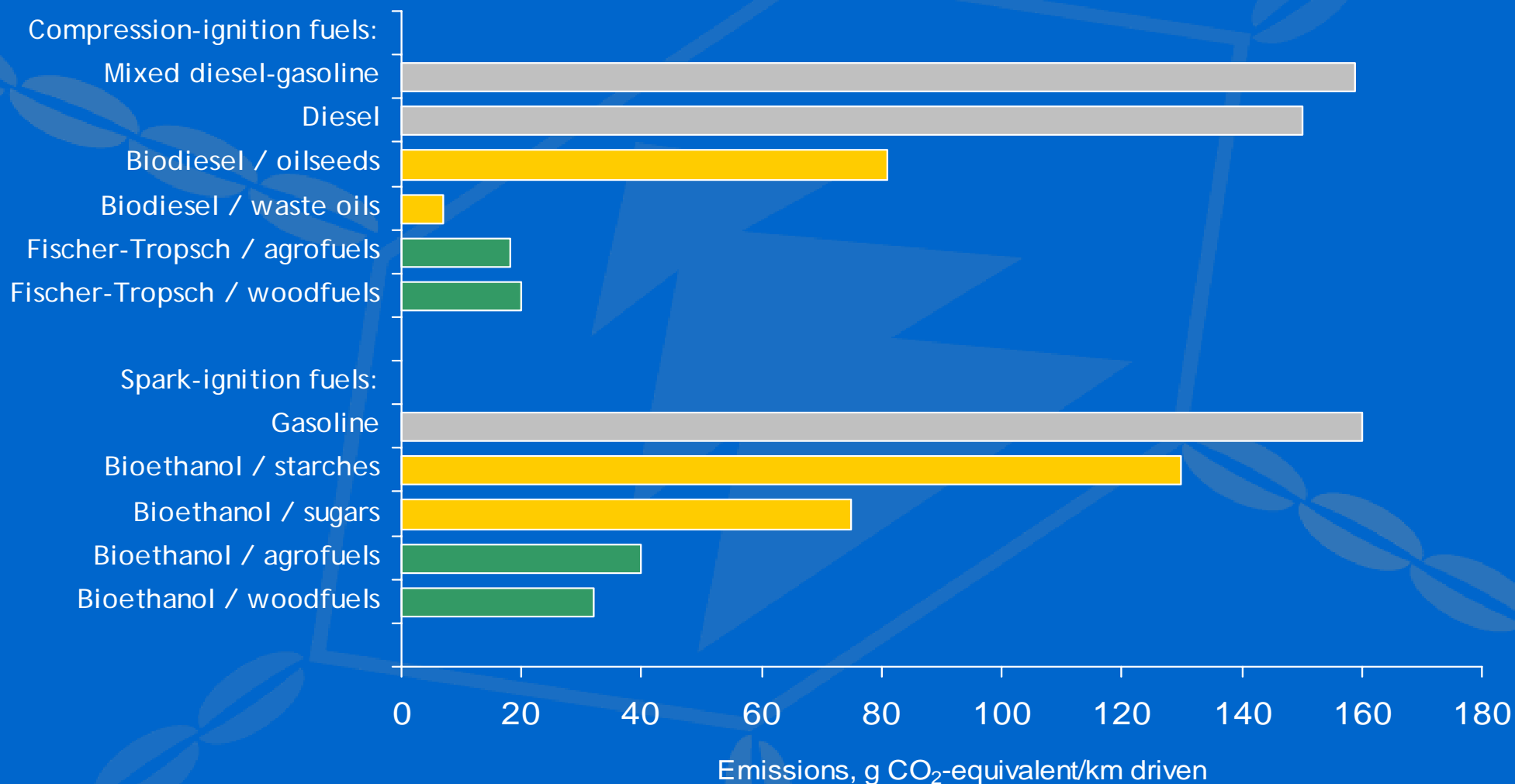
# Energy balance (energy investment vs. output)

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# GHG Emissions (biofuel technologies)

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Forest Products Biotechnology at UBC

# Food vs. fuel

## (Mexican tortilla crisis)

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- Between August 2006 and January 2007, prices for tortillas in Mexico rose 3-4x, reaching about \$1.81/kg (US)
- Cause was reputedly high maize prices and a shortage of Mexican supply, due to increased exports to the USA
- However, most biofuels rely on 'yellow' corn, while tortillas are made from 'white' corn
- However, the dispute in the media continues

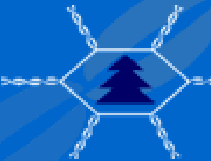


# Food vs. fuel

## (food commodity prices, 2020)

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- Schmidhuber (FAO, 2006) found that the extra demand for biofuel feedstocks has resulted in increased global agricultural commodity prices
- An increase in food prices would impact food security in some nations, particularly where food is scarce
- A price increase for food commodities would likely increase incomes in rural areas and potentially reduce poverty
- Historically, real prices for food and agriculture have been declining, and a departure from this trend to meet biofuel demand may not be permanent





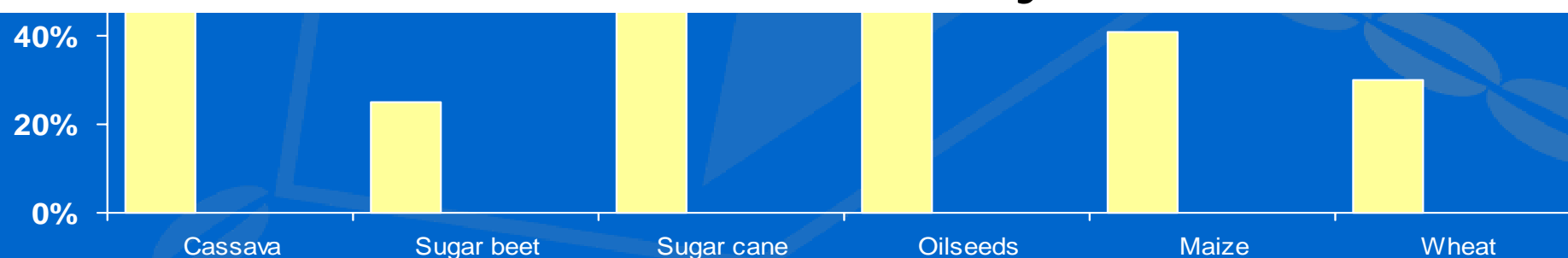
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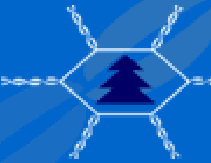
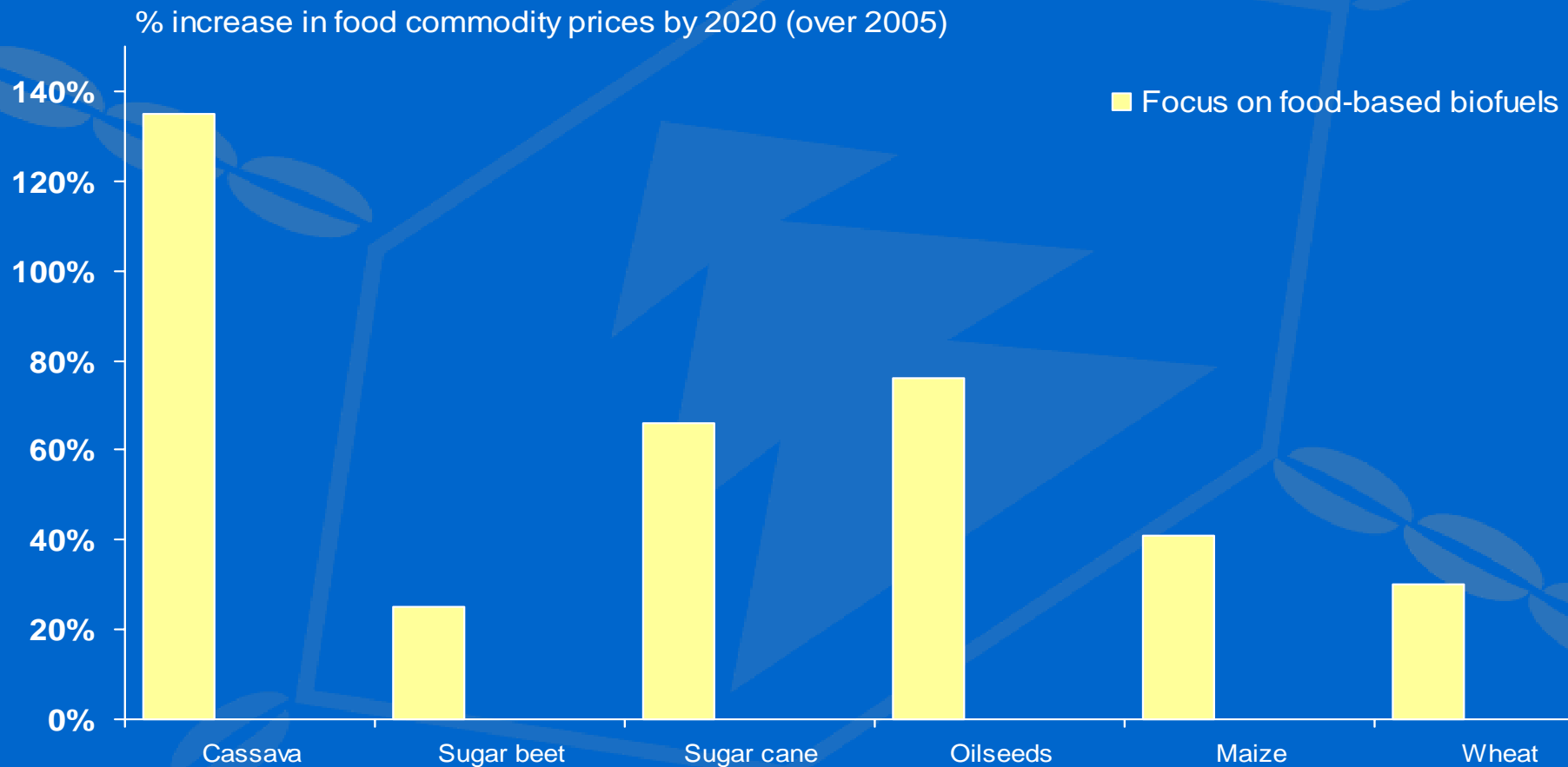
Study by the International Food Policy Research Institute using the IMPACT model (Rosegrant et al. 2006) found that, under an aggressive scenario of biofuel growth, biofuel use would rise by 2-10x



# Food vs. fuel

## (food commodity prices, 2020)

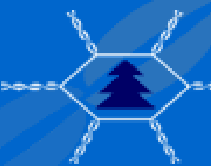
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- Influence of bioenergy
- North American issues
- Take-home messages



# Food vs. fuel

(food commodity prices, 2020)

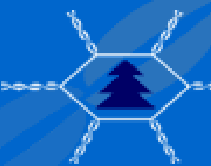
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(food commodity prices, 2020)

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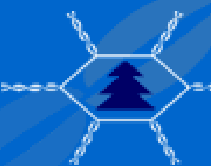
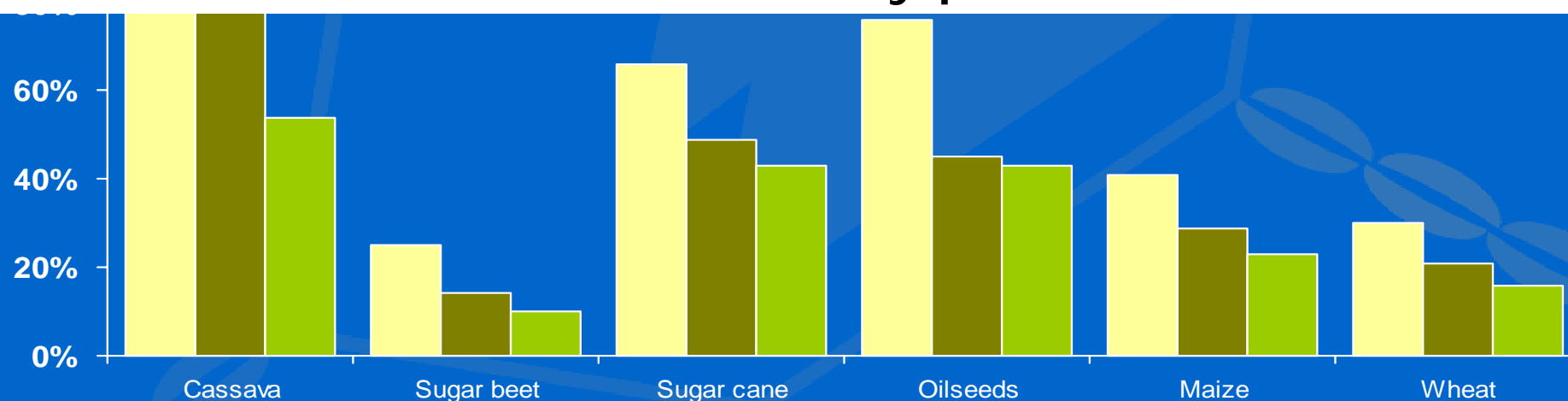
# Food vs. fuel

(food commodity prices, 2020)

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**Wood-based biofuels can help minimize expected increases in food commodity prices**



# North America goals

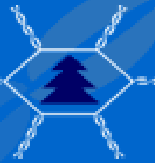
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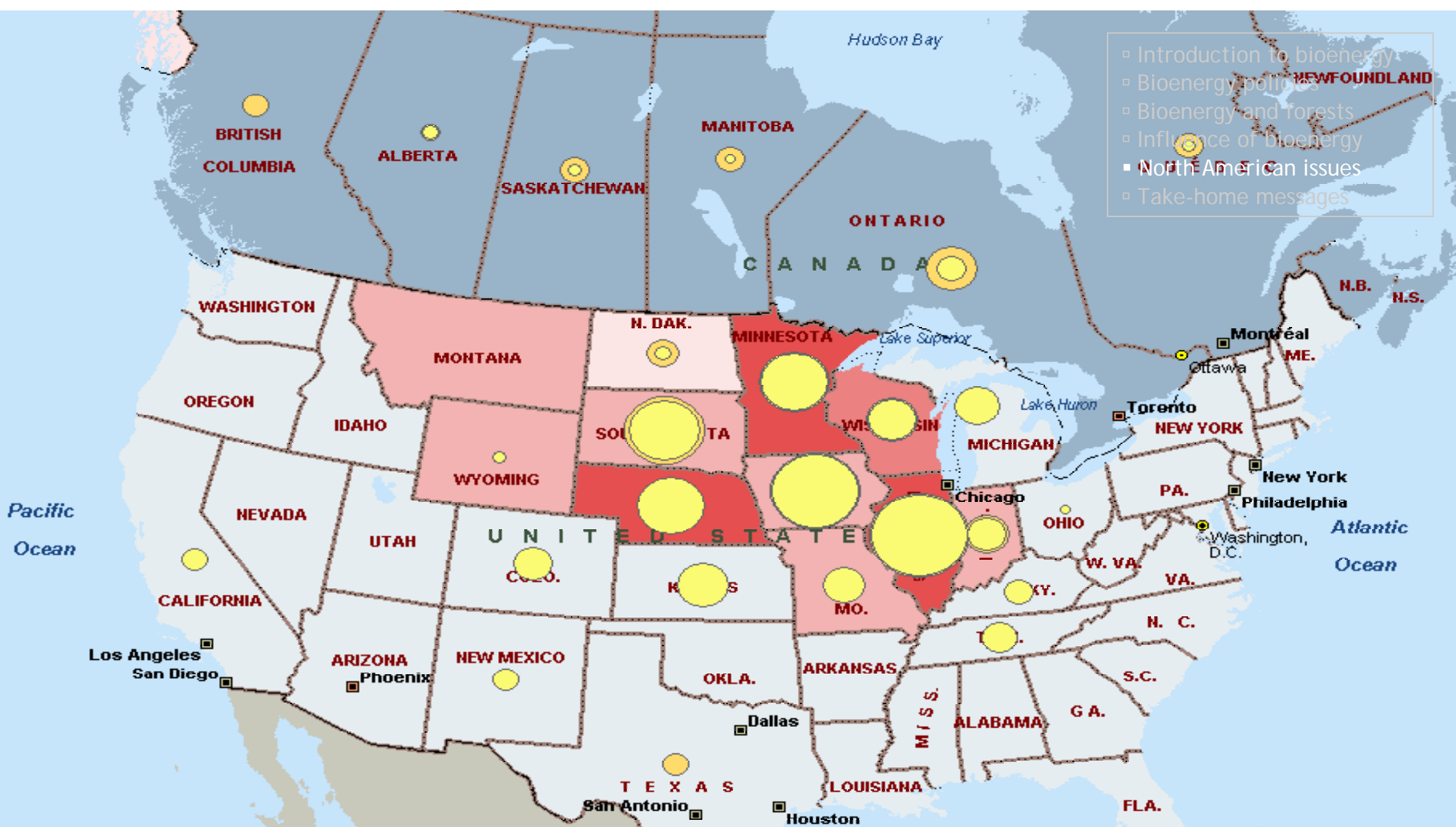
## ■ United States

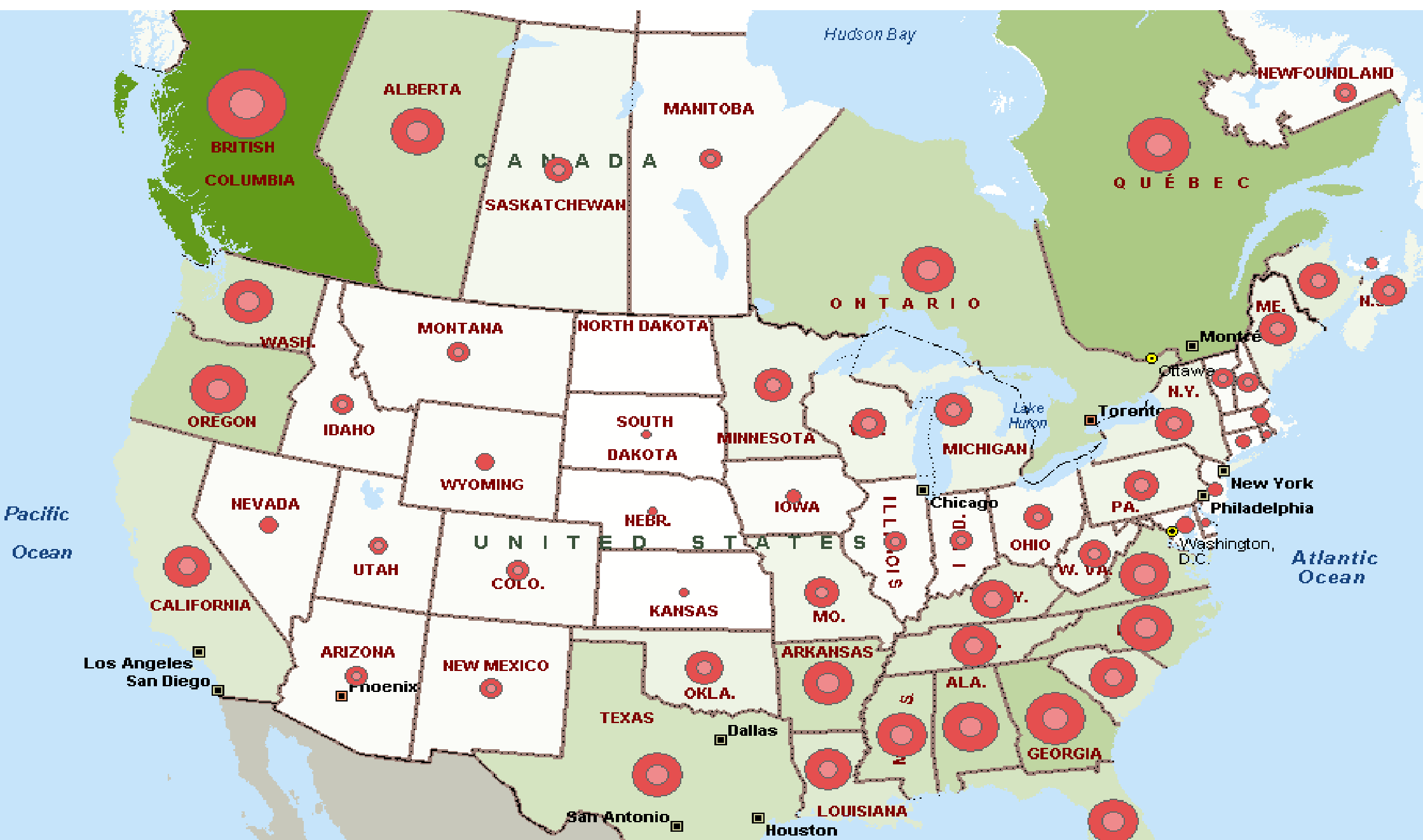
- Triple bioenergy and bioproducts use by 2010
- Identify 1 billion tonnes of cellulosic feedstock for energy and fuel production by 2030
  - 368 million tonnes forest biomass
  - 933 million tonnes agricultural biomass
- 133 billion litres of renewable fuels by 2017
- 30% bioethanol in gasoline by 2030

## ■ Canada

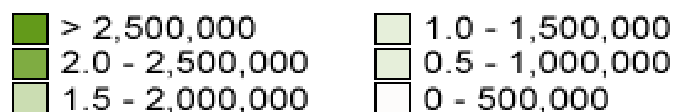
- No national bioenergy target
- Provincial-level bioenergy goals being developed
- 5% bioethanol in gasoline by 2010
- 2% biodiesel in diesel fuel by 2012



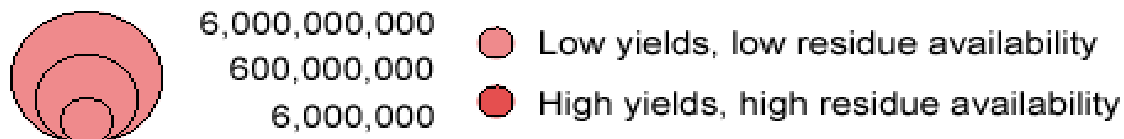




Forest Residues 2005 (metric tonnes)



Potential Production of Ethanol (Litres annum<sup>-1</sup>)

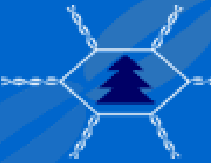
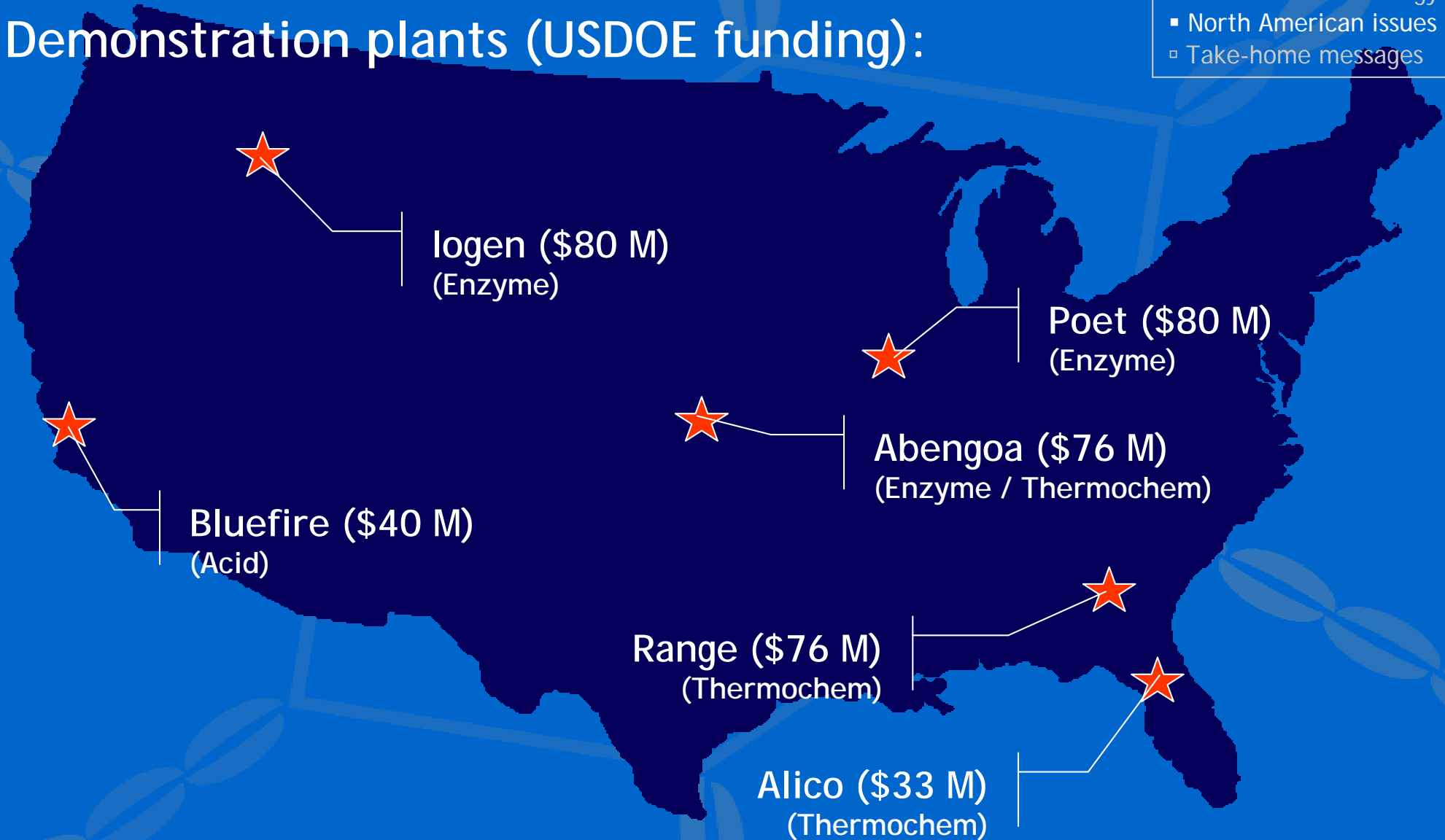




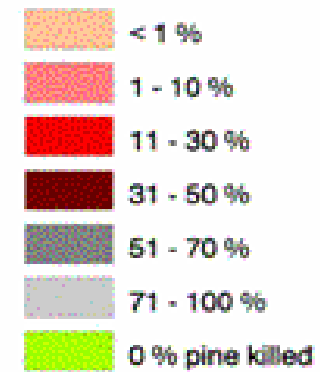
# Cellulosic ethanol

## Demonstration plants (USDOE funding):

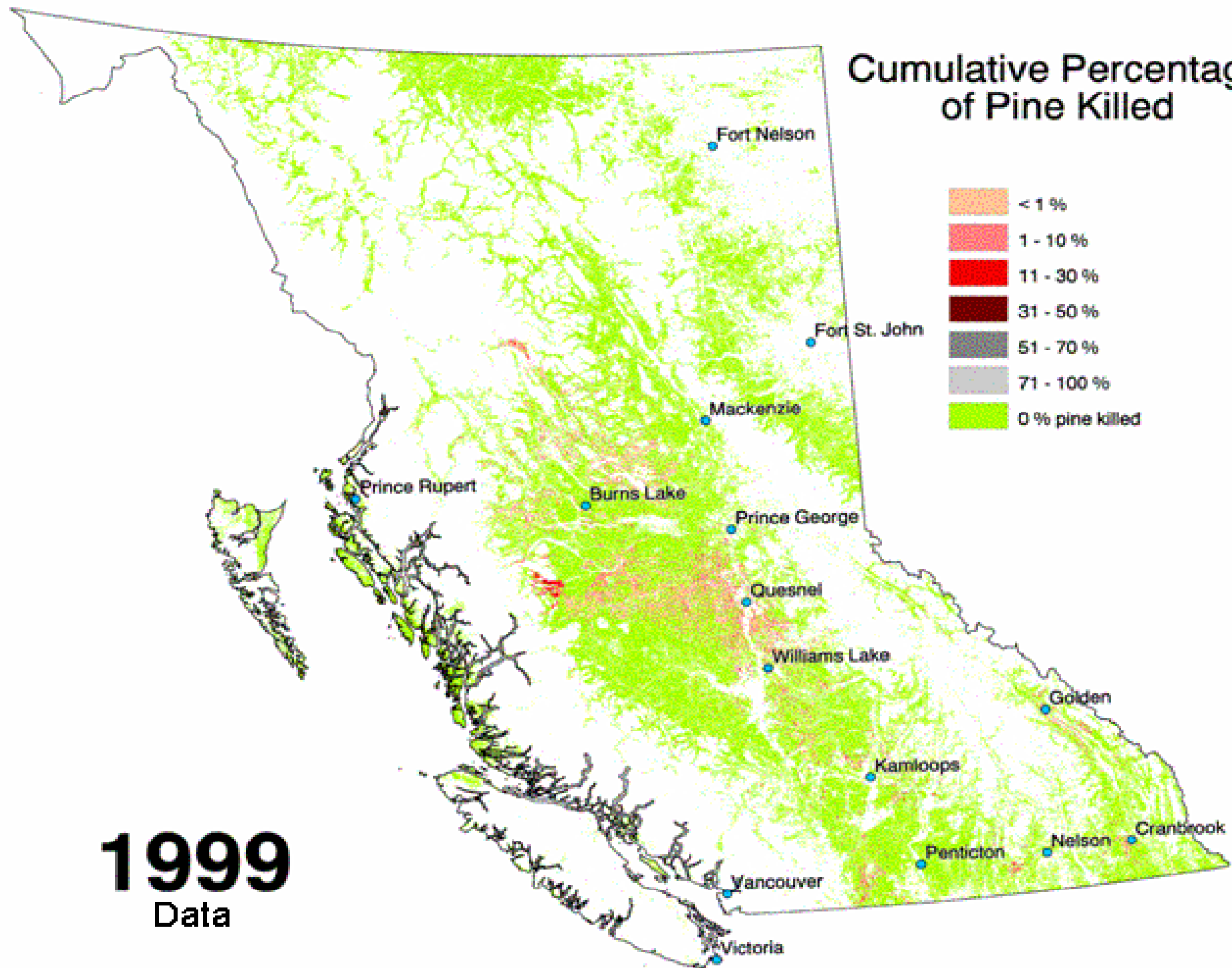
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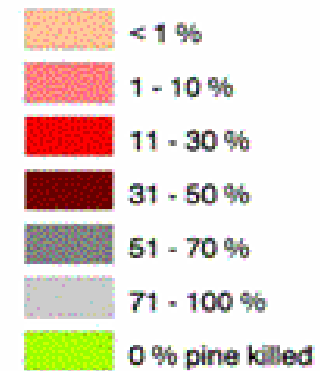
## Cumulative Percentage of Pine Killed



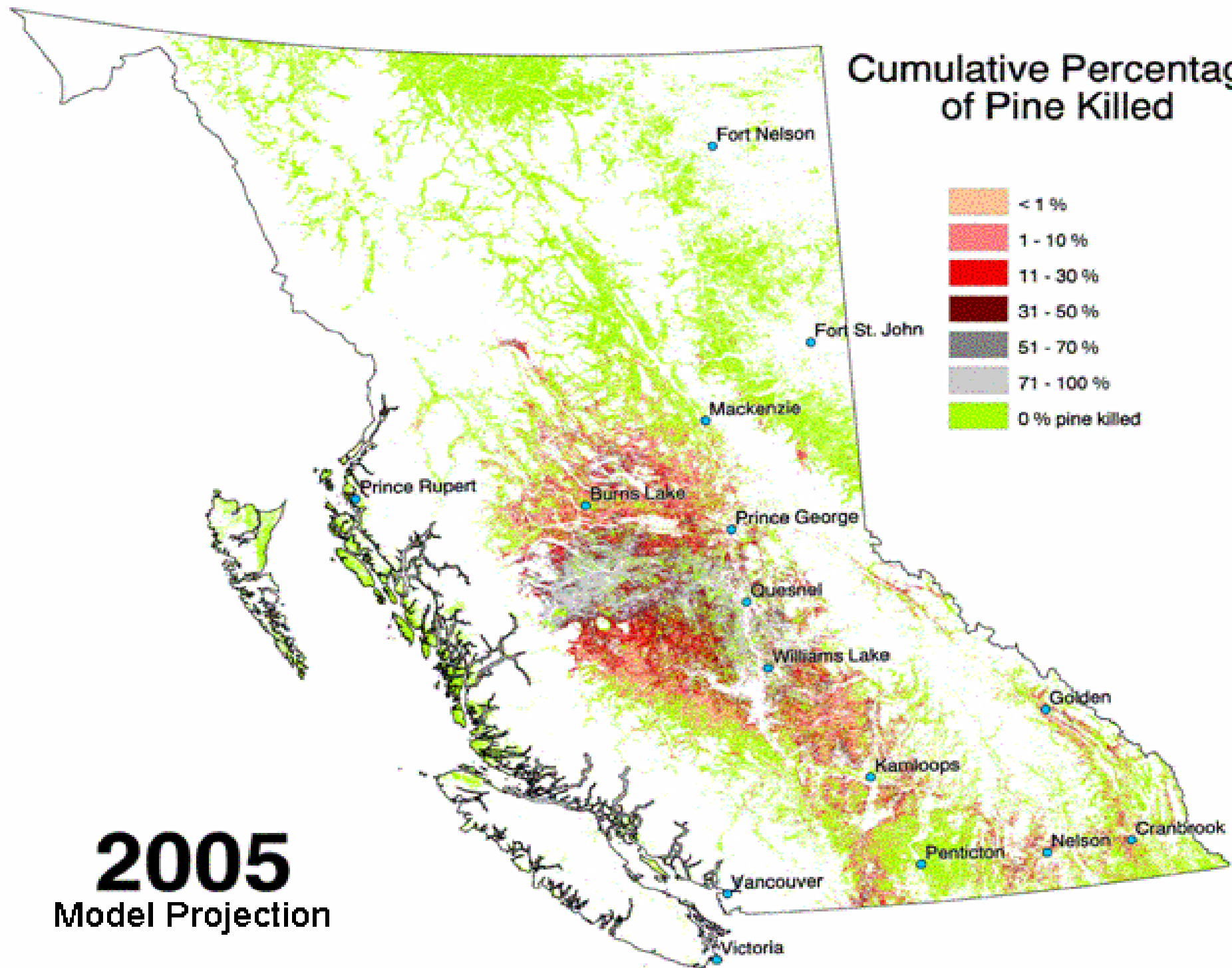
**1999**  
Data



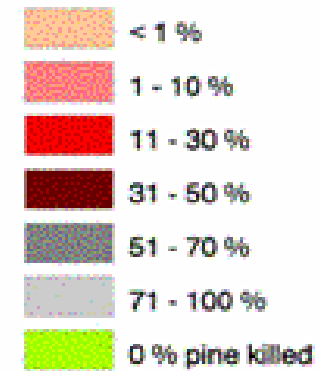
## Cumulative Percentage of Pine Killed



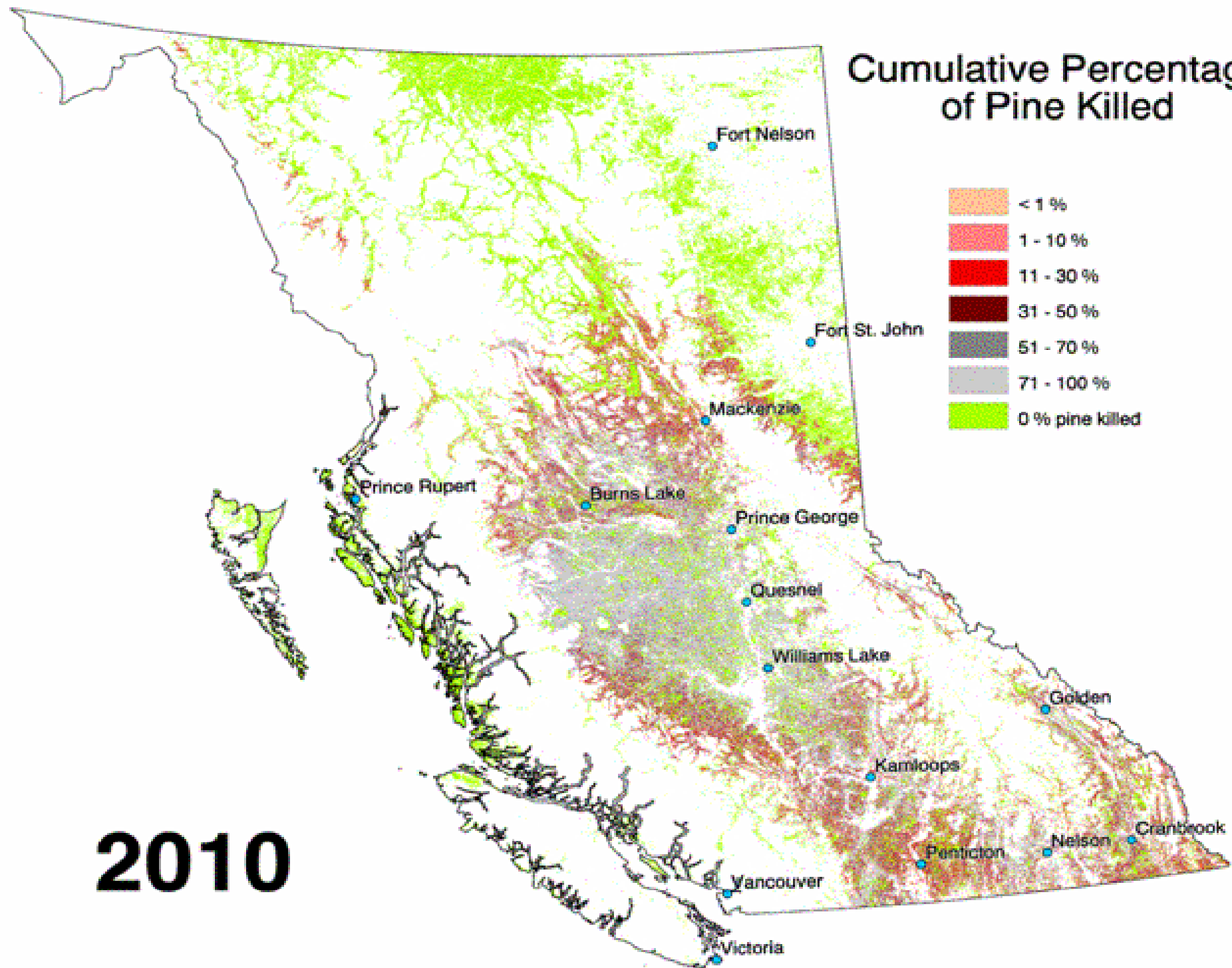
**2005**  
Model Projection



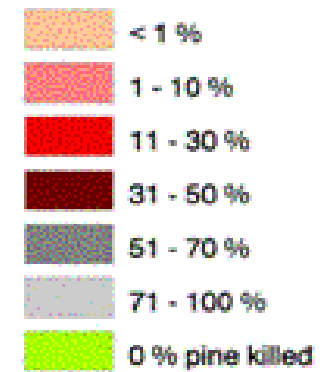
## Cumulative Percentage of Pine Killed



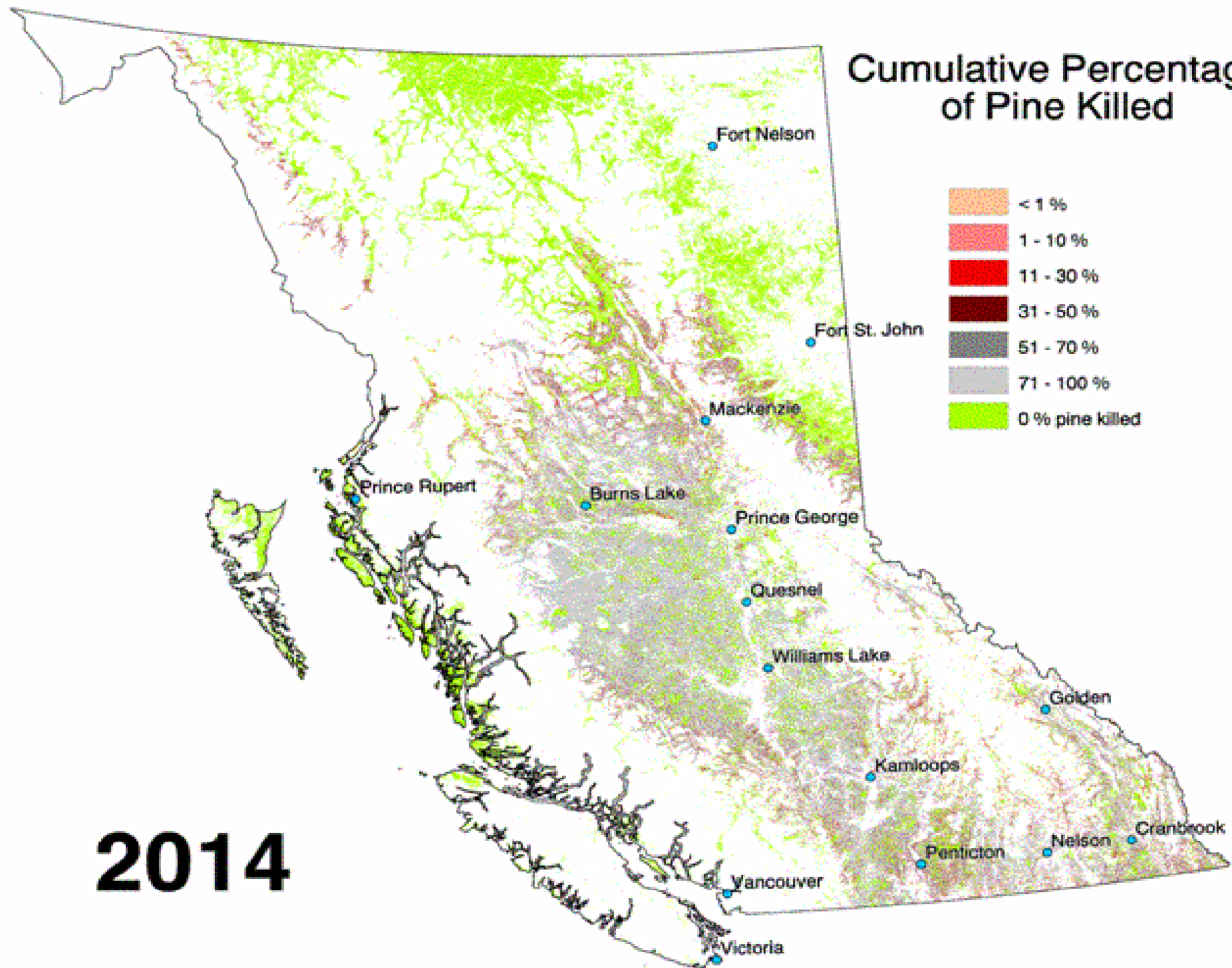
**2010**



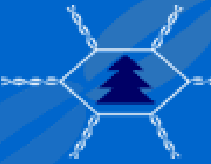
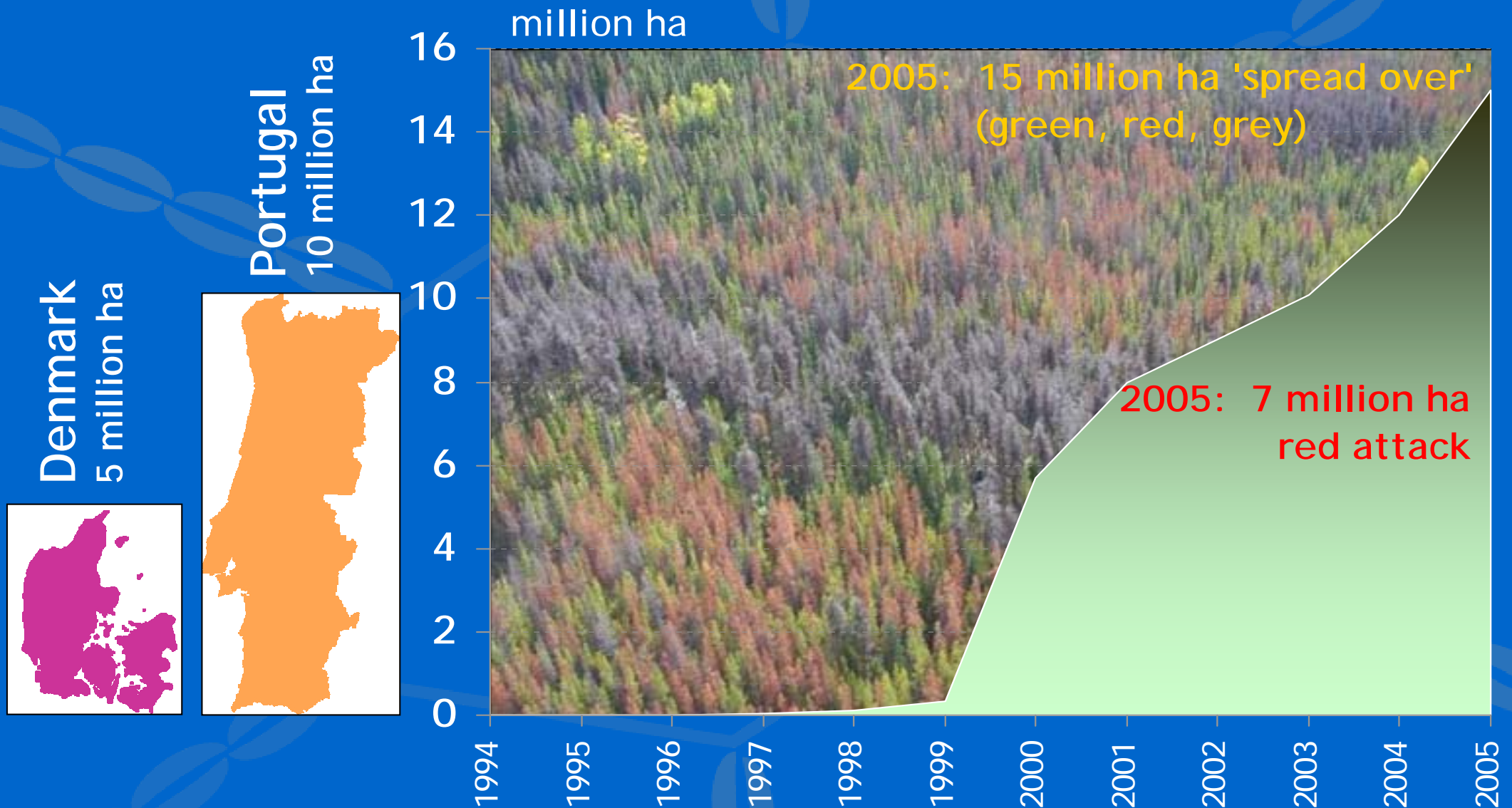
## Cumulative Percentage of Pine Killed



**2014**



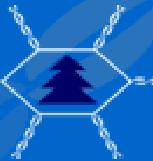
# Cumulative impacts - area



# Take-home messages

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- Research is still required, including development of better data describing biomass recovery from forests and trade opportunities for biomass and biofuels
- Policy does not yet define the role of forests; clear bioenergy policy goals would help define the size of the opportunity for forests
- Policy impacts include an increased role for biofuels as well as bioenergy in the form of heat and power; this may result in great increases to forest biomass demand
- When pursuing a biofuel future, wood-based biofuels can:
  - Improve energy balance over food-based biofuels
  - Reduce GHG emissions over petroleum fuels and food-based biofuels
  - Reduce the impacts that biofuels will have on food prices
  - Help deal with local impacts of climate change





# Acknowledgements

- Food and Agriculture Org.  
(Wulf Killman & colleagues)
- International Energy Agency  
(Bioenergy Tasks, Task 39)
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- Forest Products Biotechnology,  
University of British Columbia

