SESSION 7
Paper (d)

ENERGY IMPLICATIONS FOR SMALLWOOD HARVESTING

J.R. TUSTIN

Forest Research Institute

Introduction

The oil crisis has forced many countries, including New Zealand, to examine their energy future. The objectives of these studies are invariably:

(i) to seek independence from Middle East oil production and price increases

(ii) to establish, as far as possible, energy security by focussing on domestic production

(iii) to ensure safe, long term solutions by a transition towards non-nuclear, renewable energy sources such as hydro, geothermal, wind, solar and biomass (agricultural or forestry crops).

These goals have led to a wide spectrum of R & D activity in the oil deficient countries. No two countries have the same set of resources available for exploitation or energy opportunities available for development. None the less, woody biomass from forestry is seen as a potentially important element in the energy plans of many countries, including Canada, USA, Sweden, Finland, Brazil and New Zealand. This focus on wood for energy not only offers the grower another market but also frequently raises a smallwood harvesting challenge for research and management. The result is a new generation of activity in such fields as:

- the use of "pre-commercial" thinnings
- salvage of cutover residues
- swathe harvesting of "unmerchantable" stands
- Development of roadside chipping units
- merchandising (centralised processing and sorting) of whole trees
- investigations of "mini" rotation crops and their harvesting, transport, storage and preparation for processing.

New Zealand's situation

In common with other oil-dependant nations, New Zealand's main

energy problem relates to transport fuels. There are no significant oil fields, although a number of promising areas remain to be explored. Natural gas and coal reserves are substantial but finite. They can help to "buy" lead time for a switch to renewable sources. Woody biomass is seen as one option for the production of alcohol fuels for transport. The Energy Research and Development Committee has examined 11 crop processing routes producing ethanol, hydrogen, methane and methanol. All of these fuels can be used in various ways as a transport fuel, either as a complete substitute for gasoline or in blends as a partial replacement for gasoline or diesel. At this stage production based on fodder beet or radiata pine feedstocks look the most promising.

National Wood Supply

Figs 1 to 4, provide an overview of the national afforestation effort and wood supply situation. The main points are:

- Plantation forests currently oover only 3% of the country's land surface. At the projected rate shown this will rise to 7% by 2015. Radiata pine is the predominant species because it grows very well in a wide range of climates and soils. Figures 1 and 2, represent a "likely" scenario derived from the NZ Forest Service 1977, "National Forestry Planning Model". The ultimate size of the plantation estate is a subject for future policy.

- The effect of the planting pattern is to generate a very large wood supply, surplus to domestic-demand for conventional forest products (e.g. sawn timber, paper, particle board and plywood). In practice there are many permutations of felling strategies. Management objectives are usually aimed at sawlog crops in 25 to 30 years. Felling these stands earlier is feasible, but involves a sacrifice of log size and quality. These in turn adversely impact costs and market flexibility so should not be entertained lightly.

- Conventional forestry is based on the harvesting of stem wood to a specified merchantable top diameter (often 10 cm). The rest of the tree, including bark, is waste. Figure 3a shows the stem wood supply to the year 2015. The effect of harvesting all the above ground biomass, i.e. branches, needles and bark as well as the stem wood is shown in Fig. 3b. This is the hypothetical upper limit of biomass supply in the absence of major changes in management strategy. (e.g. energy forests grown on an 18 year rotation). Research indicates that if the needles are left unharvested the loss of key nutrients is minimal.

- Future wood supply is largely concentrated in seven major project areas. See Fig. 4. These are identified on the basis of land availability, suitability for radiata pine afforestation and proximity to export ports.

Implications for Harvesting

At least part of the large and expanding wood surplus is potentially available as a feedstock for liquid fuel production. How this resource is allocated between potential users is dependent, among other factors, on the price they can afford to pay for the parts of the tree which meet their input specifications. For liquid fuels production, the wood specification is expected to be relatively undemanding. In some processes all of the tree is potentially usuable. The main factor is a cheap delivered cost for the feedstock. This is especially important in that feedstock costs are expected to be a large proportion of the total production cost of alcohol fuels. Liquid producers will compete most intensively with the wood pulp industry and export chip industry for raw material. A key issue is the price competing industries can afford to pay for various parts of the tree. Research results indicate that the cheapest way to produce biomass for liquid fuels is as a by-product of sawlog crops. (Untended energy forests will be much more expensive) Forest and mill residues are the most promising feed stock options but "waste" thinnings also present an opportunity if costs are low enough. Alcohol fuel production from wood should facilitate more complete utilisation and improved allocation of the various tree components between competing end-uses.

Energy Ratios

The energy ratio picture is highly favourable for both ethanol and methanol. From wood to ethanol we expect a net gain of at least 7 times the energy input, while from wood to methanol the gain is at least 11 times the energy input. Inputs included in these figures include the energy in growing and management, nutrient replacement, harvesting, transport, wood preparation, and conversion to liquid fuels.

GROWTH OF PLANTATION FOREST AREA AND NATIONAL WOOD SUPPLY

Fig. 1
New Planting 1925-79 Projected New Planting To 2015

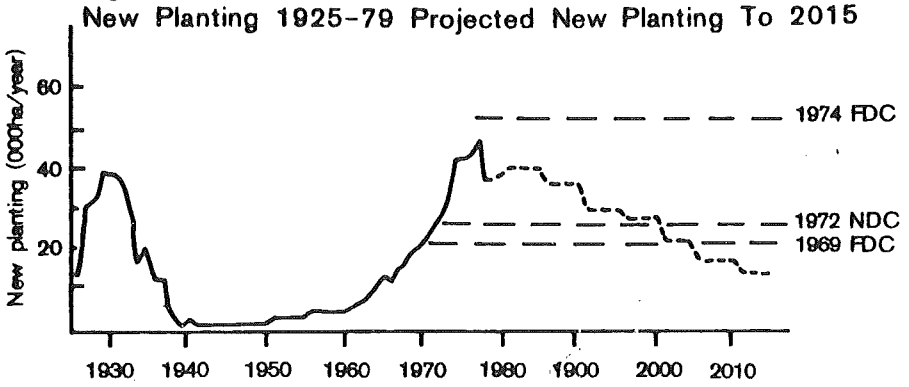


Fig. 2
Growth of Exotic Forest Area Since 1925
and Projected Growth To 2015

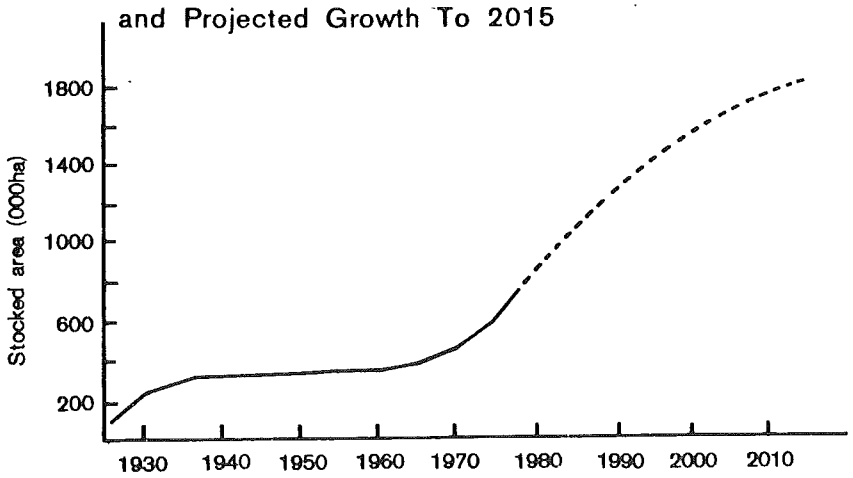


Fig. 3
Projected wood supply from scheduled pattern of harvesting

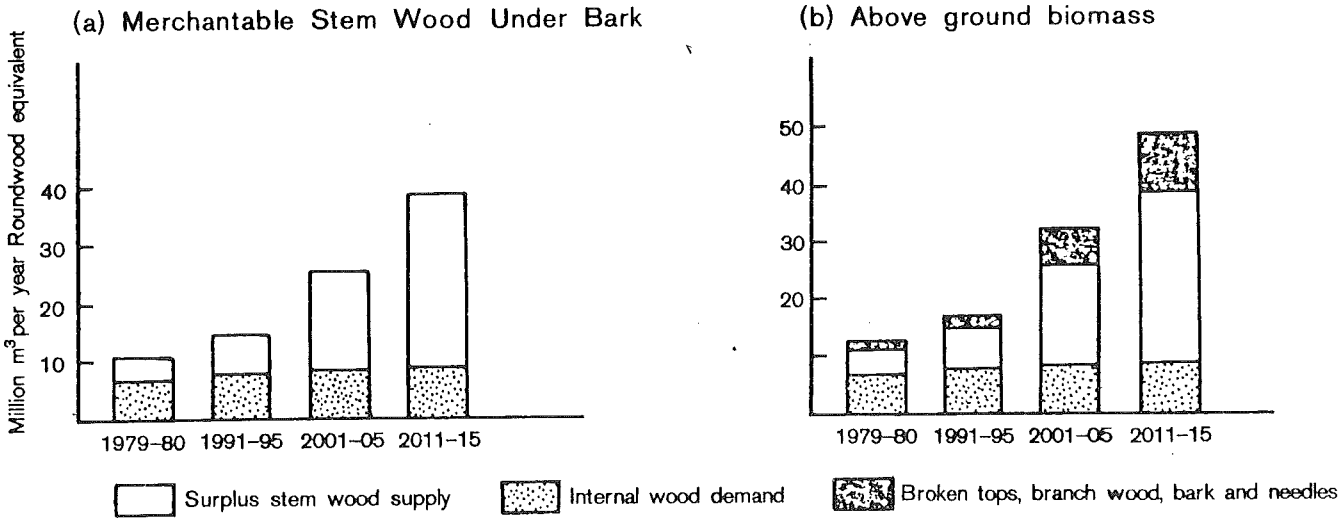
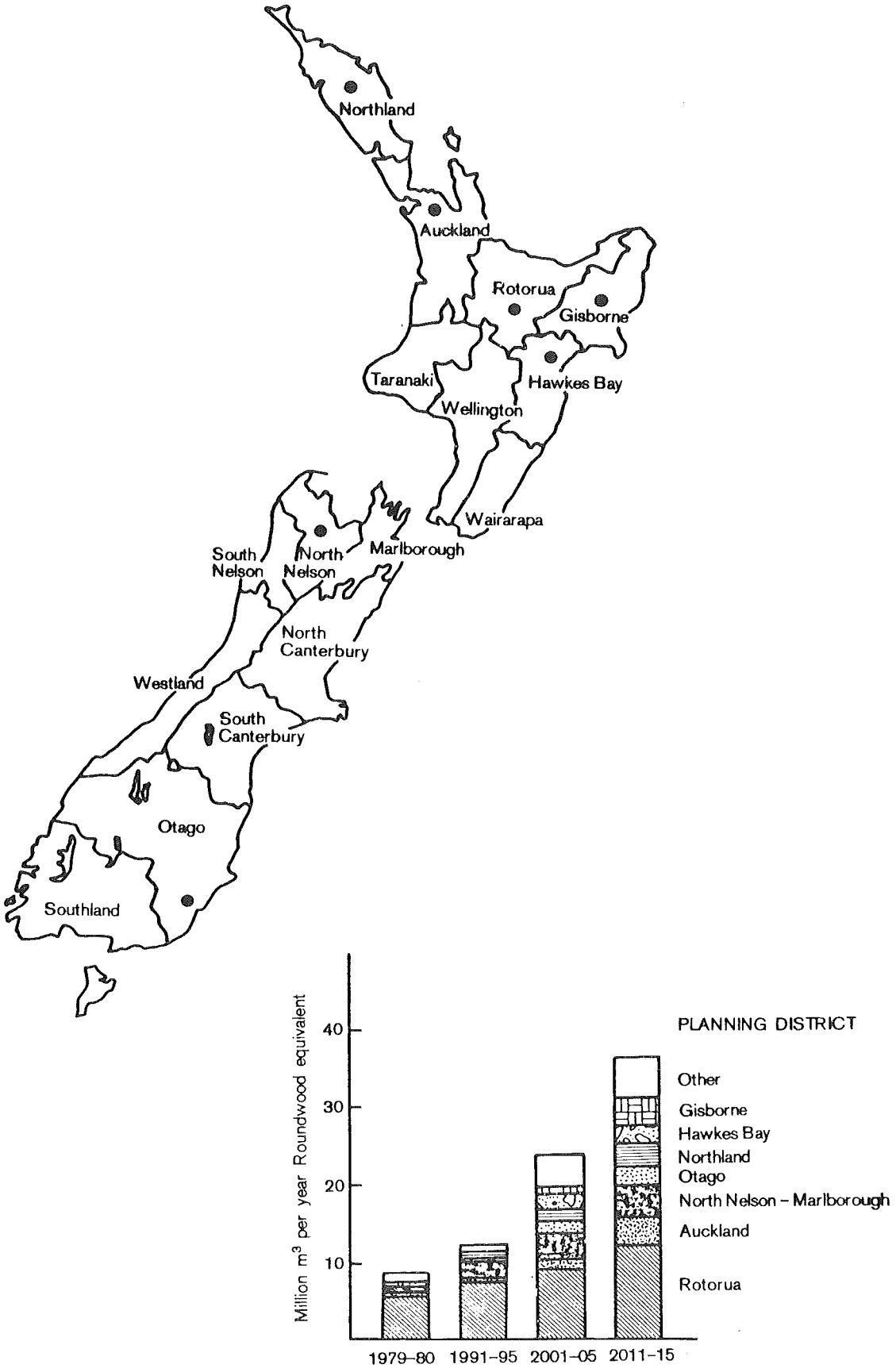


Fig. 4

WOOD SUPPLY* BY MAJOR PROJECT AREAS

New Zealand Forest Service Planning Districts



★ Merchantable Stem wood under bark for scheduled pattern of harvesting

● Major Project Area