# Recent Destruction of Natural Vegetation in Tasmania

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**Landsat imagery has been used to map changes from native vegetation to improved pasture in Tasmania; the near-infrared waveband was found more useful for this purpose than colour composite or other waveband images. At least 74,000 ha of native vegetation were converted to pasture in Tasmania between 1972 and 1980 and more than twice this area was converted from natural vegetation to all other uses during the same period. This rate of clearing may result in some serious ecological and economic losses.**

The world's seemingly insatiable appetite for material goods has resulted in the last few decades in an accelerated loss of natural ecosystems to agriculture, plantation forestry, urban development, impoundments and waste land. For example, tropical rainforests have been estimated to be diminishing at a rate of twenty-five million hectares a year (Myers, 1978).

The conversion of natural vegetation to other land uses has important implications in many areas. These include forestry, nature conservation, soil conservation and hydrology. Thus, some considerable benefit might accrue from the availability of a simple method of monitoring such land use change through time. Landsat imagery provides the opportunity to undertake such monitoring, and has now been available in Australia for more than a decade. In this paper we attempt to calculate the loss of natural vegetation to other uses on mainland Tasmania in the period 1972-80. This project was undertaken because we believed that extensive clearance of natural vegetation had taken place since — and possibly as a result of — the initiation of a 2,000,000 tonne per annum woodchip export operation in 1971, and because we wished to be able to explore some of the implications of the pattern and magnitude of clearance. The project was feasible only because appropriate satellite imagery was available.

**Interpretation of the Landsat imagery**

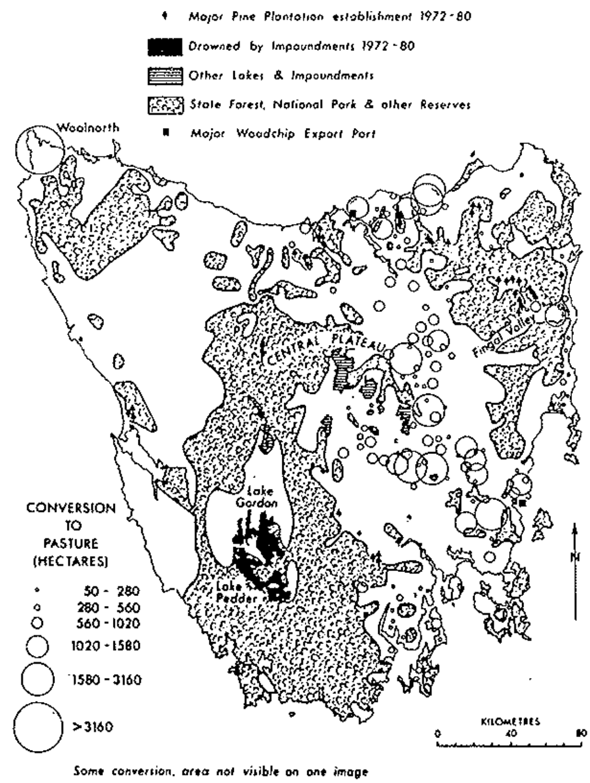
The interpretation of any remote sensing imagery requires 'ground truth' data in order to correlate the tones on the images (reflectance) with reality. We gained considerable experience of the pattern of land clearance during the collection of ground truth data for a 1:250,000 vegetation map of the state. Thus we were readily able to correlate reflectance patterns with the reality of clearance.

Landsat imagery was available for most of the state for 1972 and 1980. For some areas images were available for all four wavebands and as colour composites. We found that infrared band 7 gave the best discrimination between agricultural land and native vegetation, although band 4 was superior in discriminating categories within both types. The colour composites were inferior for all purposes. Using band 7 there were no problems in discriminating between agricultural land and recent clearfell coupes, the blackened logs and bare earth after logging and slash-burning giving a different reflectance from either pasture or ploughed land. After three-to-five years clearfell coupes are virtually indistinguishable from uncut forest on all wavebands. Coniferous plantations are difficult to distinguish from native forest even on band 4. On this band it seems possible to discriminate between forests with dense understories and other native vegetation types, and it is also possible to discriminate between unimproved and improved pasture.

The boundary between cleared land and native vegetation was traced from the 1:250,000 1980 images. The tracing was then placed over the 1972 images — which were at the same scale, although slightly distorted — and the areas of change marked (Figure 1). It was found difficult, using this procedure, to map cleared areas consisting of less than 25 ha. Also, some areas were not covered in one or other year, or were covered but were obscured by cloud. Thus, our figures underestimate conversion to agricultural use.

*Other sources of information*

As the satellite images could not be used to measure the area of natural vegetation lost to plantations of *Pinus radiata*, we have used figures for private and public plantation establishment kindly provided by the Tasmanian Forestry Commission. An unknown but small proportion of pine planting during this period took place on land previously cleared for agriculture. The area of land covered by water as a result of impoundments created by the Hydro Electric Commission was obtained from topographic maps. The loss of natural vegetation to urban land use was not calculated, but is insignificant compared to other losses, almost all urban expansion taking place in already cleared areas. The nature-conservation implications of the clearance patterns were gauged from our unpublished vegetation maps and previous survey work (Kirkpatrick, 1977).




**Spatial pattern of conversion to pasture, pines and impoundments in Tasmania.**

*The scale and pattern of clearance*

The analysis of satellite imagery revealed that in the period 1972-80 at least 74,000 ha of native vegetation was converted to improved pasture. Of this total at least 69,500 ha previously was covered by dry eucalypt forest, the remaining being heath country. Two-and-a-half percent of the total forest cover and 6.9 percent of the private forest cover was lost to pasture in eight years. Losses to pine plantations amounted to approximately 24,000 ha. Hydroelectric impoundments covered 51,800 ha. Altogether 2.3 percent of the area of mainland Tasmania was converted from natural vegetation to other uses, a total area of approximately 150,000 ha at an average of approximately 19,000 ha a year.

Most of the conversion of forest to pasture took place along the margins of already cleared land, or in remnant patches of native vegetation in the midst of already cleared land. Clearing was concentrated in areas readily accessible to the major woodchip export ports (Figure 1) and took place almost totally in dry eucalypt forest with grass, bracken or sclerophyll shrub understories on moderate to gentle slopes in areas receiving less than 1000 mm of precipitation per annum, and on soils which require frequent fertilization to maintain improved pasture.

## Discussion

With the possible exception of the pine plantations established near the west coast and in the Fingal Valley, the destruction of natural vegetation took place for economic motives. The Fingal Valley and west coast pine plantations were established largely to provide employment in depressed areas. The economic and social arguments for and against hydro-electric impoundments and pine plantations are well-known, and will not be reiterated here, except to observe that the authorities, companies and individuals responsible for these investments believed them to be economic, in either the narrow sense of return on investment or the wider sense of their return to society. Natural vegetation has been traditionally attributed with little or no value, so its loss must weigh poorly in development decisions.

Natural vegetation weighs poorly especially when compared against pasture by agricultural land holders. The royalties obtainable from the sale of private pulpwood have been insufficient to encourage the retention of natural vegetation of land marginally suitable for pasture establishment, but sufficient to make such pasture establishment economically viable (Everett and Gentle, 1977). Of the estimated 2.8 million hectares of forest in the state in 1972, approximately one million were privately owned, nine-tenths of this area consisting of the poorer quality eucalypt forests from which most of the export woodchips were to be obtained (Everett and Gentle, 1977). In the first half-decade of woodchip export operations an average of 44% of pulpwood production came from private land, and a Tasmanian Forestry Commission survey of the fate of private land logged for wood chips indicated that 41% was being converted to agricultural land use and 9% would be of doubtful future use for wood production (Everett and Gentle, 1977).

It might be assumed that much of the privately owned forest land occurs in areas too steep and/or rocky to allow economic pasture establishment, and that the most suitable areas for conversion have been logged first; hence, that the loss of private forests will rapidly diminish to insignificant proportions. The record of the first eight years of woodchip export operations suggests that, if such a diminution is likely, it has not yet occurred. The Forestry Commission survey, which covered only the first three years of woodchip export operations, revealed a rate of conversion to pasture of 6000 ha of forest per annum. Thus, in the latter five years of the eight-year period at least 10,000 ha of forest per annum have been converted to pasture. Field observations suggest that woodchip operations are taking place on all qualities of private forest land, and that extremely large areas of private forest land similar in all respects to those already cleared remain uncut. Thus it may be safer to assume that 40% of the total private forest estate will be converted to pasture, than to expect private forest diminution to cease.

If such a substantial reduction in the area of the private forest estate does take place, there will be a serious reduction in the sustained yield of wood possible from Tasmanian forests. If the sustained yield of pulpwood from all Tasmanian forests in 1972, as estimated by the Forestry Commission, is taken as the base, and it is assumed that cleared private forests would have had the same mean yield as the surviving pulpwood forests, the drop in sustained-yield wood production will be substantial. By 1980 the sustained yield expressed as a percentage of the 1972 sustained yield would have been 98%. If 40% of the private forests are converted to pasture the percentage would be 86%. Even without loss to pasture, the private forests are being cut at a rate far in excess of that necessary for sustained yield and much of their area is not adequately regenerated (Everett and Gentle, 1977). These figures need to be seen in the context of an economy in which forest-based industries contribute a quarter of the value added in manufacturing and employ over 10,000 people in a state with a population of approximately 430,000 people. Of course the economic losses which will certainly be caused by this private forest clearance need to be balanced against the gains in terms of agricultural productivity. No comprehensive analysis of the costs and benefits associated with the alternative land uses has been undertaken in Tasmania.

The rate and location of land clearance has serious implications for nature conservation. It is apparent that the large-scale clearing of heath that occurred in the 'fifties and 'sixties in Tasmania continued in the 'seventies, and will probably continue until this vegetation type, important for both fauna (Guiler, 1965) and flora (Kirkpatrick, 1977), survives only in reserves which inadequately represent the range of heath communities (Kirkpatrick, 1977). The dry eucalypt forests, which have suffered the brunt of clearing, have the richest fauna in the state in terms of number of species and species populations (Guiler, 1965) and are poorly represented in the National Park system of Tasmania. *Eucalyptus rubida* open forest, once widespread in the Fingal Valley and the area to the south and southeast of the Central Plateau, has been preferentially cleared in the last decade. Few areas of this forest type survived in 1980 and virtually all were on private land. *E. amygdalina-E. viminalis* grassy open forest has also been preferentially cleared. Some large areas of this forest type remain, but most are on private land.

Satellite imagery presents a cheap and efficient means of monitoring major land use changes, such as are still occurring in Tasmania. The use of digital tape data rather than imagery may enable more exact resolution than has been possible in this study, and there seems no reason why currently available maps of vegetation and forest types cannot be integrated into a software system capable of producing maps and statistical breakdowns of clearing and its economic and ecological effects.

## References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