When The Heavenly Gaze Criminalises: Satellite Surveillance, Land Clearance Regulation and the Human-Nature Relationship

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Introduction

> 'Whenever there are men competent for the task, let them be given forest to cut down in order to improve our possessions' (Charlemagne).[1]

Many changes wrought by humanity on the environment have involved not only a dramatic change in its physical appearance and composition, but also cultural and institutional changes, for example in the view of the value of property as expressed in the extract above. In countries such as Australia, higher prices and commodity values have usually been placed on privately owned production landscapes with only the extraordinarily exquisite, or discarded leftovers remaining in public ownership. In the latter, limits have been placed on human activities and, at the same time, the purpose for exclusion is expressed in terms of the benefits to humanity. The world's first reserve, Yellowstone National Park in the United States, was declared in 1872 with the objective of preservation 'for the benefit and the enjoyment of the people'.

Similarly, the earliest known conservation laws which criminalised activities that harmed the environment in some way, were enacted to further the desires of humanity, or at least those of a privileged group. For example in the 11th Century, the habitat of game species were preserved by prohibitions against tree-felling in the New Forest (Mannion 1997). The law was limited to protecting recreational hunting by the elite from the interference of poaching by the poor. These forests were viewed as premium resources by feudal owners who recognised the impact of over-use and the importance of controlling allocation. Such utilitarian justifications continue to underpin most of the interactions that humanity has with the landscape. However, while humans may be excluded from nature as understood as 'wilderness' or 'native', by laws of public reservation and prohibition on use, in most areas of the landscape it is nature that has been excluded by human action. One of

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1 Charlemagne, *Capitulare Aquisgranense,* art 19, 77, in 'Monumenta Germaniae Historica', vol 2 p 172, 8th Century, Boretius, A (ed) (1897) cited in Glacken, C J (1967) *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the end of the Eighteenth Century,* University of California Press, Berkeley, p 763, 334.

the most obvious and dramatic ways in which nature has been excluded from the landscape is by land clearance. This changes both the nature of the landscape and the culture of the humans living in the landscape. In some areas humans have come to consider themselves as the sole occupiers, rights-holders and beneficiaries of nature. It is perhaps ironic then that the activity of land clearing has proved itself, due to the consequent decline in biodiversity, the enhanced greenhouse effect and the degradation and desertification of the land, to be offering fewer and fewer benefits to humanity and risking our long-term environmental security.

Satellite remote sensing, which is data about the earth, captured from space-borne sensors, has contributed greatly to the scientific understanding and popular awareness of the effects that human activities have on the landscape. The exposure of the decline in native vegetation cover has been especially significant in Australia. Through the 1970s and 1980s land clearing attracted widespread concern, and institutional responses, such as land clearance regulations, were introduced to criminalise unauthorised clearance of native vegetation on private land.[2] Monitoring of land clearance by satellites has since been used as an evaluation tool to look at whether or not these legislative and policy attempts to affect land usage have been materially effective in reducing the rates of land clearance. Satellite remote sensing shows that these measures have been ineffective (Bartel 2004). Implementation strategies are slowly receiving greater political attention and the extension of the role of satellite remote sensing to surveillance and policing, previously once only mooted (Bartel & Leach 2000), is now becoming real.

Satellite remote sensing is beginning to be used in Queensland and South Australia to identify compliance or transgression to land clearance restrictions, and forensically as evidence in prosecutions. Considering the degree of early advancements in this technology, its utilisation in detection and enforcement is long overdue. However, the technology has a unique surveillance capacity and only in very limited cases has there been similar types of continuous or semi-continuous surveillance implemented, for example in situational crime prevention with closed circuit television camera monitoring in public areas. Satellite images showing Indonesian forest fires have been suggested as sources of evidence for use by Malaysia, Singapore and Brunei to take Indonesia to the International Court of Justice, however this is an isolated case (Anon 1999). The closest and best-established precedent is in Europe where satellite imagery is used to monitor compliance to subsidy claims under the Common Agricultural Policy (Pederson 2000). In Australia, however, the technology is being used to support regulations that are far more controversial amongst the regulated community. While satellite monitoring for data gathering purposes (for example mapping

2 The following decade also saw continuing enactments and re-enactments in all state and territory jurisdictions. As responsibility for the environment under the Constitution (by omission) is in the hands of the states, each state and territory has its own version. For e.g. s 21(2) of the *Native Vegetation Conservation Act* 1997 (NSW) states that '(A) person must not clear native vegetation on any land except in accordance with a development consent that is in force or a native vegetation code of practice' and applies Part 4 of the *Environmental Planning and Assessment Act* 1979 (NSW) to the clearing of native vegetation. Offences constitute breaches of the s 76(2) of the *Environmental Planning and Assessment Act* 1979 (NSW) prohibition of development without consent and are therefore offences under s 125(1) of the *Environmental Planning and Assessment Act*. The maximum penalty for unauthorised clearance in New South Wales is $1.1 million. Protections also extend to public authorities and public land and incarceration is also possible under other legislation in some jurisdictions. In Queensland a timbercutter was sentenced to 12 months imprisonment by a District Court (upheld on appeal *R v Dempsey* [2002]) for felling 25 trees, including a 100 to 300 year old Queensland Maple, Maple Silk Wood, Northern Silky Oak and Black Walnut between 20 December 2000 and 2 January 2001, contrary to s 56(1) of the *Wet Tropics World Heritage Protection and Management Act* 1993 (Qld).

of landcover, farm planning and crop yield estimates) may be widely accepted, the surveillance capacities of satellite imagery have not gone unchallenged. The bases for these challenges are similar to the objections to the land clearance laws themselves. Is it right to criminalise a land usage activity that has long been seen as productive and desirable? Is there perhaps a more basic question about our appreciation of the nature of human activities or their 'unnaturalness' that deserves further consideration? And how can the utilisation of satellite imagery help or hinder us in this endeavour?

Land Clearance Legislation in Australia and the Role of Satellite Surveillance

Australia ranks ninth among the world's top land clearing nations for the last decade. Nine of the top 20 (including Australia) are classified as mega-diverse in their biodiversity. Between 1990 and 2000 Brazil cleared at a rate of 2,226,000 ha/yr, Indonesia 1,312,000, Sudan 959,000, Zambia 851,000, Mexico 631,000, Democratic Republic of the Congo (Zaire) 532,000, Burma/Myanmar 517,000, Nigeria 398,000, Zimbabwe 320,000, Argentina 285,000, Peru 269,000 and Cote d'Ivoire 265,000 (FAO 2001). Australia's land clearing rate for the period was 378,000 ha/yr.[3] This dramatic land cover change continues an historic trend in Australia. The National Land and Water Resources Audit (ANVA 2001) has estimated that 30% of the open forests nationwide have been cleared since European settlement, 30% of the woodlands, 25% of the open woodlands, 15% of the acacia forests and woodlands, 35% of the mallee, 45% of the heath and 30% of the rainforest. The amount of change varies regionally, clearance being concentrated in the areas of longest settlement, with an estimated 90% of all native vegetation types lost from the eastern temperate zone. Few areas have been left completely unaffected by some level of use. Of Kirkpatrick's (1994) estimate of 43 million hectares of native bush remaining 25 million hectares have been affected by logging and 61% by grazing.

Human-induced landcover change is not new. Flannery (1994; 2001) argues that the arrival of humans to North America and to the Antipodes resulted in major extinctions and major changes to the distribution of ecosystems due to hunting and the use of fire. The arrival subsequently of more significant numbers of humans bringing more advanced technology has resulted in far more rapid rates of change. Concern for human-induced landcover change and its consequences has been raised by the development of one of these technologies, that is satellite remote sensing. For the last 30 or so years, satellite remote sensing imagery has depicted great swaths of forested areas in Asia, Africa, the Amazon and Australia turning from green to brown. Much of the change in Australia has been due to the increasing use of land for agricultural production. Between 1990 and 1995 close to 80% of the land cleared in the major agricultural zones of Australia was for pasture development, mainly for cattle. This land clearance mainly occurred in the state of Queensland (Barson et al 2000:65).

The introduction of legislative measures and the subsequent criminalisation of land clearance, which primarily affects private landholders, have been due in part to the high rates of land clearance on private land made evident by satellite remote sensing studies.

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3 The figure for Australia used by FAO was 282,000 ha/yr, placing us eleventh but this more recent figure places Australia in 9th position. The more recent figure is from Barson, M, Randall, L and Bordas, V (2000) *Land cover changes in Australia 1990–1995. Results of the collaborative Bureau of Rural Sciences — State agencies' project on remote sensing of agricultural land cover change*, Bureau of Rural Sciences, Canberra, p 92.

Government commissioned reports utilising imagery in South Australia in the 1980s and Woodgate and Black's (1988) study of Victoria both led to legislative changes in the respective states (Kestel Research 1990).

Over the last two decades all state and territory jurisdictions in Australia have either introduced or strengthened existing administrative licensing requirements for clearing private land, with civil and criminal penalties to follow unauthorised clearance.[4] Compliance may also involve revegetation and on-going management responsibilities that may be registered with the land title. Implementation of these laws requires monitoring and satellite remote sensing may be seen as an ideal surveillance tool as it 'looks into' everyone's backyard and can determine the land usage being carried out there.

A Short Survey of Technical Capacities in Satellite Surveillance

Satellite imagery consists of pictures of the earth taken at a distance, that is remotely. Skidmore's (1998) definition of satellite remote sensing is that it is '(A) record of the Earth's features obtained from reflectance or emittance of electromagnetic radiation'. Early pictures of the Earth from space made resonant, as few descriptions could, the vulnerability of our planet. They provided powerful illustrations of the concept that our planet and its resources are finite. The earth in space became a symbol of fragility, powerfully linked with our responsibility for it. A well-known 'greenie' poster depicts the Earth against an endless sea of black universe with the tag: 'Ignore it and it will go away'.

The Earth has been far from ignored. Satellite imagery has become ubiquitous in studies monitoring change at the global and local level. From space, weather systems are continually tracked, the extents of sea ice measured and landcover change observed. Programmes such as NASA's Global Land Cover Characterisation Project, the World Climate Research Programme, the International Geosphere-Biosphere Programme and the global vegetation monitoring undertaken by Earth Observation's Space Applications Institute (Europe) all incorporate remote sensing from satellites as part of their data gathering and research.

Different satellite sensors provide different types of ground data, or imagery. Unlike conventional photography, satellite imagery is in a digital raster or grid format in which the size of each square or pixel in the grid is determined by the spatial resolution of the sensor. Military 'Keyhole' satellites have very fine spatial resolution and are therefore usually able to detect and precisely locate very small objects. Satellites used for assessing large-scale weather and landcover patterns however, do not need to 'see' everything in such great detail and have a much coarser view. The 1.1 kilometres x 1.1 kilometres pixel size of AVHRR data from the NOAA satellite (and its affordability) mean that it is often used for monitoring of continental scale landcover change. It is unsuitable for applications requiring high locational accuracy and greater detail, since these require higher spatial resolution. Carterra imagery from the IKONOS satellite (launched September 1999), has a panchromatic band with a spatial resolution of 0.82 m, and multispectral spatial resolution of 3.28 metres in four bandwidths.[5] Satellites carry a number of detectors for each bandwidth and the surface reflectance of electromagnetic radiation is selectively measured within these bandwidths and recorded as area weighted averages for each pixel.[6]

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4 For a recent review see Productivity Commission 2004, *Impacts of Native Vegetation and Biodiversity Regulations*, Report No 29, Melbourne

5 Carterra data has recently been purchased by the NSW Government for landcover monitoring purposes.

Change in land cover is detected by the change in spectral message or signature received for each bandwidth, or band. There are no unique spectral signifiers for specific land cover types (only water can be unfailingly detected, by its inability to reflect the infra-red spectrum). However, through experimental use and examination of spectral relationships, many land cover types can be identified using semi-automated techniques. The Landsat satellites, with a spatial resolution of around 30 metres, have been used for most of the data gathered on Australian land clearance and have provided the most reliable continuous record of land cover change in Australia. The Landsat 7 satellite was launched in April 1999, providing similar data to that of its predecessor Landsat 5. Data from Landsat 5 has been available since 1983 and from its predecessor from 1972. It was the early data from the older Landsat satellites that led to the regulatory response which criminalised unauthorised land clearance in South Australia.

The interpretation of satellite imagery for the purposes of mapping and for surveillance is a process of categorisation; the Earth's diverse surface is simplified into land cover types to reduce the complexity. This also makes it easier to assess a change in conditions.[7] For ongoing compliance, repeat surveillance is important as land use is an ongoing activity. Evidence of a contravention related to land cover change lasts longer than evidence of pollution, which may be blown or washed away. In the future an element of 'rapid response' may be instituted by real-time monitoring, which is essentially shortening, via systemic and automated processing techniques, the turn around time between data acquisition and identification of clearance locales. Timely discovery is also important to ensure that statutory limitation periods do not run out.[8] From past patterns of land clearance it may also be possible to identify areas at risk, for example if a remnant of a once larger size has been diminished, further loss may also be likely. Vulnerability may also be graded according to spatial relationships, for example areas closest to existing production and areas that are unfenced or inadequately fenced may be at greater risk from stock grazing than other areas. Private tenure is also a causative and therefore predictive factor for unauthorised land clearance.

One of the biggest problems with the current time-efficient methods of satellite monitoring is that by 'ignoring' the clearance of grasslands, sparser woodlands, shrublands, wetlands and heathlands, and patch clearance of areas smaller than 1 hectare, the area of clearance is underestimated. Legislative protection as well as monitoring has been very much 'on the side of the trees'. The popular perception of native vegetation is tree-centred, as are the aims of projects for addressing salinity and land degradation. In Queensland the law only covers trees. In the future, national and state policies and market forces that favour the planting of exotic and non-local native trees in monocultures, may achieve greenhouse targets without however, accomplishing the aims of biodiversity protection. Land clearance

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6 Other satellites with higher resolution capabilities are the French Spot satellite which produces 10 m square pixels in black and white (panchromatic) and 20 m square pixels in four electromagnetic wavelength ranges, or bandwidths and the DigitalGlobe's QuickBird satellite has a similar range of multispectral and panchromatic data to that of Carterra.

7 The Landsat bands most useful for identifying the presence or absence of vegetation are the red and near infra red bands (Bands 3 and 4). These bands are often related in ratios or indices as 'greenness' indicators; to detect areas of higher vegetation relative to lower. A thresholded greenness indicator may be used to categorise cover types or all cover types may be classified according to their spectral signature, by categorising the relative reflectance or spectral signals of the surface into (for example) areas of forest cover, urban areas and bare land.

8 For example the limitation period for enforcement in South Australia is 3 years (6 with the approval of the Minister, see sections 33 and 35 of the *Native Vegetation Act*, 1991 (SA)).

is also often referred to merely as deforestation and the absurdity of this term's focus on trees is made apparent by comparing it to its appropriation for other vegetation types: 'degrassation', 'deheathation'.

The New South Wales State of the Environment report (NSWEPA 2000:6.3) criticised the current amount of information concerning native vegetation, stating that: 'There is a paucity of data on the condition of native vegetation communities ... The range of clearing rates varies widely depending on the methodology used'. The greater resolution provided by alternative data sources such as Carterra increases the processing time, by creating more information than is required which then needs to be filtered out. Although increased resolution is unsuitable for monitoring larger areas, it is eminently suitable for monitoring urban restrictions and to track the fate of individual trees, which are protected by local planning laws and decisions, significant trees legislation and the South Australian land clearance legislation.

Current and Future Challenges for Satellite Surveillance

One necessary condition for a regulatory implementation strategy to be effective is sufficient monitoring, at least to assess compliance. As Grabosky (1995:360) observes, lack of monitoring can weaken regulation. This should not however, be assumed to be a serious consideration for those 'concerned with image rather than substance [of law] ... But for those seeking to effect genuine change, some kind of monitoring system is essential'. Detection is essential for deterrence. In a classical conceptualisation of deterrence, most famously stated by Bentham, observance and compliance with law is principally generated by the threat of punishment. For such a threat to operate as a disincentive the probability of detection, apprehension and prosecution must be high and the likely penalty outweigh the benefit of contravention. Detection is also important for an appreciation of the merits or demerits of that behaviour and its consequences. In the area of land clearance regulation, harm is inchoate but evidence of the extent of the actual harm caused by the offence is essential in sentencing, especially where proportional sentencing policies are favoured, for example in New South Wales. Satellite remote sensing can assist in determining factors important in sentencing, such as the size of the area of the land cleared, the vegetation type cleared and the replacement land usage.

Satellite surveillance monitoring of adherence to land clearance regulation is technically an ideal solution for the disparateness of the regulated community and the lack of point source or point impact style of damage. Another advantage of the broad field of view provided by satellite remote sensing is that all landholders are brought within it, not just those who bring attention to themselves by applying for a permit. By comparison, detection of 'traditional' criminals is a reactive process, relying heavily on reporting by victims, informants and witnesses. In the traditional policing of criminal law, the criminal can rarely be apprehended whilst carrying out the criminal activity and is only apprehended if there is evidence of a conspiracy. The success of policing, or the achievement of the 'order' side of the law and order question, is measured in terms of reported crimes solved. However, there is no way of knowing how many crimes are actually committed. Declining crime rates therefore may or may not reflect successful crime prevention. The number of crimes reported serves as an indicator, but is not an absolute measurement, of the safety of social conditions or the deterrence effect of law and order. Satellite remote sensing surveillance differs from traditional policing and other environmental monitoring in its capacity to be employed as an all-seeing eye, to firstly identify all regulated behaviour, whether it be beyond compliant, compliant or transgressive, and secondly to serve as an evaluator of the regulators by monitoring implementation strategies.

Queensland is now using remote sensing in a systematic way to identify illegal land clearance, by matching the locations of vegetation loss apparent in imagery to the areas in the Department of Natural Resources and Mines' permit register. Over 2000 and 2001, the Statewide Landcover and Tree Survey (SLATS) has identified 61,000 hectares of possibly illegal or exempt clearance, that is clearance that did not appear in the register. As a result over 3,000 sites are being investigated by the Department's prosecution branch (Sullivan 2003). Satellite mapping also assists in building the databases upon which the Department administers and decides permit applications. There has already been criticism (for example by rural lobby group Agforce in Queensland) that satellite maps are insufficiently accurate to be used as a basis for granting permits, as some vegetation and property boundaries have been found to have been misplaced, leading to permits being granted over inappropriate areas (Robbins 2001). The claimed scientific accuracy of remote sensing must be able to withstand cross-examination in the court where, for example, expert witnesses are used.

In South Australia satellite imagery trials have led to several prosecutions. However, there remains a reliance on public reporting of breaches, which effectively outsources the detection aspect of policing to the public. Reporting of clearance therefore, is concentrated according to population densities and is dependent upon awareness of, and presumably support for, the legislation. Over half of the reports received each year between 1999 and 2001 were from highly urbanised areas, such as metropolitan Adelaide, the Yourke and Fleurieu Peninsulas, and Kangaroo Island. The fewest number of reports arose in the north and west of South Australia, where there is less conflict over land use, less sympathy perhaps for the legislation and fewer pairs of eyes due to the lower population density. Greater clearance of vegetation occurs in the south-east of the State and it is also more noticeable because the vegetation being cleared is more 'obvious' vegetation such as woodland. It is far more difficult for humans, and satellites, to detect degradation of grassland by over-grazing, which is prohibited by South Australian law.

In Victoria, where the policing of land clearance is the responsibility of each local council's enforcement officer (who may also call on police and authorised officers of the Department of Sustainability and Environment, formerly DNRE), councils have very few resources for monitoring and are reliant on community reporting. The Municipal Association of Victoria (MAV 2000) proposed that a random checking system be instituted which involved sending letters to people asking them whether they had conformed to land clearing permit conditions and 'those that have not, or that do not reply would be monitored and prosecuted if they do not abide by the controls'. This type of monitoring is limited to those who have already placed themselves within the system by making an application. In a survey of staff from 45 councils conducted by the MAV in November 2000, 32 out of the 45 interviewed said that there was a lack of resources and/or staff and 14 complained about the reliance on community reporting. Survey respondents also wanted information about all vegetation cover, not just trees. One respondent said that the lower and middle storeys of vegetation were often forgotten in monitoring and enforcement, and another said that the knowledge of grasslands was particularly poor (MAV 2000:10, 17).

In New South Wales, officers from the Department of Infrastructure Planning and Natural Resources (formerly DLWC) are at present totally reliant on reports of illegal clearance from the general public. The Department received over 2000 reports in 2000 and 2001, which is four times the number received in 1995 and 1996 after SEPP 46 was introduced. As the Department's draft compliance policy notes however, although '(R)eports from the community are highly valuable, systematic programs are also needed to detect alleged breaches'. The policy states that random audits are conducted to track compliance, therefore those already in the system (by applying for a permit) may be more

likely to be exposed. The Auditor-General's Performance Audit Report (2002:44) however, found that the Department 'conducted few formal compliance audits and little systematic compliance monitoring', noting that on-site property checks may only be made at the time of permit application, and only for large applications or when Crown pastoral leases (in the west of the State) were transferred.

Policing of land clearing regulations in most states appears to be hampered by a lack of systematic monitoring and lack of commitment to employing satellite technology to detect infringements.[9] With the exception of Queensland, policing in Australia continues to be 'outsourced' to the public. Where clearance is likely to be greater, such as in expanding rural areas informer reluctance may be high.

The deployment of remote sensing in its 'big-brother' mode, that is to police landholder behaviour at the property and paddock level, may be feared to be politically unpalatable. It is this, rather than any technical deficiencies, that has led to its slow uptake. It may be politically unpalatable for a number of reasons. The general public appear largely unaware of the capacities of present public and private satellites. Ikonos2, the satellite that provides Carterra data, has been likened to Big Brother in a front-page newspaper article, which showed an image of the city of Melbourne (Mascall & Dare 2000). Few people are aware that their backyards are routinely mapped by several satellites and most would be unaware that military satellites such as the Keyhole can 'see' in resolutions of centimetres (Richelson 1998). Concerns range from being 'spotted' in one's backyard pool to having competitors monitoring one's production levels (Phillips 1999). As the utilisation of satellite surveillance increases one can predict that intentional evasion may become a concern. Studies of pollution have shown that enforcement strategies involve both the regulatees and the regulators, who both utilise counter-strategies, including delaying tactics, intimidation and evasion (Hawkins 1984:120). Satellite signals may be distorted by manipulating ground conditions, for example 'adding' spurious cover to approximate vegetation when it has actually been removed or by degrading the vegetation to prevent it being classed as deserving of conservation (Binning & Young 1997:28).

The potential exists for the policing of landcover change to be far more intrusive than regular reactive policing. Although remote sensing saves resources and inspectors' time, it may be the case that landholders themselves would prefer a knock at the door rather than a camera in the sky. Satellite surveillance may also be objected to on the grounds that the land clearance restrictions themselves have been opposed. For example, the discontent about private costs being incurred as the boundary between private production and public conservation is blurred, and the criminalisation of traditionally productive activities. Satellite surveillance may be viewed as unreasonable in policing generally but perhaps more specifically in the context of land clearance regulation, which lacks widespread ground-based support amongst the regulated community and has suffered from a low degree of voluntary compliance.

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9 Restrictions in Tasmania were only introduced in 2002 and Western Australia has only recently strengthened earlier legislation to bring it into comparable line with the other states discussed here, see further Bartel, R L (2004) 'Satellite Imagery and Land Clearance Legislation: A Picture of Regulatory Efficacy?' *The Australasian Journal of Natural Resources Law and Policy, vol* 9, no 1, pp 1–31.

Satellite Surveillance: Sensing a Division between Humans and Nature

> 'New World countries, such as Australia, New Zealand, USA and Canada, are typified by a strong functional and symbolic separation of nature and culture. Visions of ecological integrity and cultural integration seek to blur this distinction, creating patchy landscapes in which in situ nature conservation occurs as an integral part of commercia land use activities' (Hamblin 2000:1).

Satellite pictures demarcate areas of human habitation and use, from other areas. Labelling an area as a certain land use by definition excludes other uses that may exist in the same location. For example, one major satellite study concluded that about 40% of Australia is intensively used for agricultural production (cropping, pasture etc), plantations and urban and residential purposes. In total 60% of Australia is used for agriculture (Graetz et al 1995). The implication is that some areas are solely used to produce for and house humanity, and the areas remaining are unproductive. By categorising the vorld as such, satellite imagery divides the world often according to the boundaries of private and public ownership and traditional production and preservation. This division obscures the fact that nearly every landscape on earth has been or is used and modified by humans. It hides the fact that areas of native vegetation are also production landscapes for humans they are used by humans for recreation and amenity, to produce filtered water and air, to preserve biodiversity and for other ecosystem purposes. In some areas the history of inhabitancy and modification by First Peoples runs for millennia and to such an extent that the ecosystems viewed as natural by the invading conquerors can arguably be described as cultural artefacts. Traditional production landscapes are not exclusively human. They house native flora and fauna and indeed the 'human' production carried out in an area is entirely dependent on the pre-existing 'nature' in the area. Enforcing the 'us and then' dichotomy of human versus nature, that has grown from our self-awareness and perhaps he distancing effects of technology and industrialised living, obscures important facts that may impair our cultural development and therefore our interactions with the landscape.

In many areas of Australia production is now criminalised and conservation enforced on private land. Historically, the act of clearing was considered part of the definition of ownership, for example Locke's (1690) notion of ownership arising from a 'mixing of labour with land'. In Australia clearing was often a condition of leasehold and freehold land grants: land purchase agreements required it and land selection laws from the mid-1800s demanded that settlers improve their land by clearing. This liberal and capitalist history of property ownership has often caused considerable resistance to the fettering of what are perceived as inalienable rights of land use. However, the idea that landholders are also land-stewards is also part of the culture. The idea of environmental stewardship arises from a Biblical notion that has a variety of interpretations; from warranting a form of benevolent custodianship to authorising patriarchal domination. Environmental stewardship also has ecocentric roots, in the idea that humans are ecological actors holding responsibilities and duties to and for nature. The legal recognition of these responsibilities and duties links them to property and therefore to property owners only. In the South Australian case of *Backhouse v Judd* Justice Napier observed that '(T)here is nothing novel in the idea that [ownership of] property is a responsibility as well as a privilege'.[10] According to Baden and Stroup (1990:132) '(I)t is important to understand that ownership does not entail the right to use that property in a way that is costly to others'. Young (2000) predicts that the role of

10 [1925] SASR 395.

satellite technology will extend beyond surveillance by 'putting the onus back onto landholders', for example an environmental-loading based tax for the impact of individual properties' production on the environment could be calculated and charged to the landholder.

The boundaries between public and private have been blurred by land clearance regulations but they still effect a strong spatial demarcation at the property level. The boundary between conservation and production imposed on private land is felt by many landholders as a cost. It may be that costs should be imposed beyond the farmgate. Unsustainable farming practices cause public harm, because native vegetation produces public goods such as ecosystem benefits. According to a user pays philosophy, land stewardship is not just the landholders' duty but that of all beneficiaries: of the broader society. The Victorian Government (DNRE 2000) recognises that 'the permanent care of our natural environment is one of the most important duties of government'. Presently the broader community obtain a benefit at no cost, if landholders produce public goods such as ecosystem preservation. Rather than criminalising traditional agriculture, the users of benefits arising from the native vegetation could be made to pay through government introduced taxation, or via the market. Presently, there are some market forces towards sustainable farming in its production sense but there is little accountable value in preserving vegetation for the landholder: 'Some of the harm caused to the environment is due to the absence of markets for certain natural resources and environmental amenities ...' (Industry Commission 1998). Privatisation is presently seen as hollow in dollar terms for the landholders, as they receive no identifiable financial benefit from their ownership of in situ native vegetation. The only benefits landholders accrue occur in the possibility of conversion, that is land clearance releasing the land to a more profitable use. While the situation may be seen as a market failure that has required the current move toward criminal legal intervention, it has also been argued that the market can offer a solution.

A Market View to Provide Environmental Justice: The Solution or the Same Problem?

Agriculture contributes over 3% to Australia's $600 billion Gross Domestic Product and accounts for $16 billion (22%) of Australia's export earnings. Agriculture also provides over 300,000 jobs mainly in the grain, sheep, beef and fruit industries (ABS 2002). These figures fail to take into account the full costs and benefits of production. A traditional criticism of the market, often used to justify regulatory intervention, is the failure of the market to account for externalities in pricing goods. This includes the under-valuation of the on- and off-site and out-of-time costs of production and the use of natural resources and services (including benefits foregone). The following definition of externalities describes their creation by market failure: 'An externality arises when production or consumption by one party entails uncompensated costs or benefits that are not paid for, by others' (Industry Commission 1998:72). Since the costs of degradation and rehabilitation, and the benefits of in situ vegetation, are unbudgeted for in agricultural production valuations, primary producers do not at present bear the full costs of production, there is a hidden subsidy. Users do not pay either because the products are not priced or paid for appropriately, or, in the case of public goods, paid for at all. The under-valuation and non-inclusion of externalities skews a cost-benefit analysis even further. For example, the discounting of land prices gives an artificial comparative advantage to most commercial endeavours and makes scientific research and conservation measures difficult.

It has been argued that ecosystem benefits are not marketable commodities and their production has never been paid for as there is no way of excluding non-paying users. Randall (1994) says it is possible to create a more inclusive accounting of environmental benefits. Randall suggests triple bottom line accounting as a way of accounting for social and environmental costs and benefits, as well as those costs and benefits that are more ostensibly economic. However, there are few operational precedents of this type of accounting. Most accounting of this kind has been theoretical only, for example in Australia the PM's Science, Engineering and Innovation Council (2002) made an account of the future costs of environmental damage, including species extinctions and salinity. Lockwood et al. (2000) have estimated the value of remnant vegetation to landholders and Costanza et al. (1997) have made a global assessment of the value of ecosystem services. A new bottom line may drive acceptance and appreciation of the presence of nature in landscapes hitherto regarded as human, as well as the effect humans have on all landscapes, even those hitherto regarded as wilderness. However, economic analysis remains fundamentally focussed on valuing everything in purely monetary terms, whereas there are other values that are attached to the landscape and land use. Further privatisation and commodification may merely attach pricetags to the landscape and there are equity issues around entry into the market and the distribution of wealth. Furthermore, the identification of ecosystem services presumes human beneficiaries. Similarly the early conservation and preservation laws, arguments for biodiversity's material benefits, and even aesthetic contributions (depending on how wide one wishes to cast the anthropocentric net), are limited to the instrumentalist or consequentialist and therefore utilitarian sphere. These arguments ignore the 'for own sake' intrinsic value or essentialist arguments.[11] Intrinsic value arguments recognise the inherent and inalienable right of living beings to exist, irrespective of their value to humanity.

A more inclusive valuation of the effects of consumption may require the expansion of a monetary estimation to include the 'fragile, intangible, or unquantifiable' (Tribe 1974), the 'incommensurables' (Hardin 1968), the 'non-use/intrinsic/existence' (Industry Commission 1998:76) values and absolute goods. In many cases it is difficult to give an accurate (for the purposes of assessment) monetary value to environmental resources and the costs generated by their use, and it may be entirely impossible to assess the monetary worth of non-use values such as the intrinsic value of environmental resources independent of human existence. There may be some things, like sanctity of life and the freedom to evolve, that are priceless. These values and costs are hard to account for when a product's value is usually only recognised, and recognised as having its greatest value, in relation to the price that will be paid for its ownership or consumption. Fully internalising these externalities requires that a monetary value be assigned to things whose value is difficult to estimate in dollar terms. This is even more difficult when looking at future monetary estimations of value. Intergenerational equity requires that costs to future generations are included, however future benefits are often discounted, and may actually be incalculable if they really are priceless.

Economic analysis is limited because it recognises only monetary value, only assessment by comparison, and therefore only one means of assessing the quality of life and assessing good. The only 'good' attainable (at best) via the traditional market is to achieve the efficient allocation of scarce resources, which itself assumes that there must be a type

11 The utilitarian have been described by Eugene Hargrove as the 'bread and medicine' arguments, 'The Paradox of Humanity: Two Views of Biodiversity and Landscapes,' in Kim, K C & Weaver, R D (eds) *Biodiversity and Landscapes: A paradox of humanity* (1994), Cambridge University Press, New York, pp 173–86.

of optimal resource use and does not envisage no use. Economic analysis is limited as it exists within an enduring growth paradigm, without acknowledging that there are limits to growth. Broader economic accounting retains 'capitalism's leitmotiv' (Low & Gleeson 1998:163) of commodifying resources. Commoditisation or monetising may be unpalatable ideologically and inclusive pricing does not necessarily lead to conservation if the costs are still outweighed by the benefits of consumption. As with the deterrent effects of law, the costs must be so great that no benefit will outweigh them. This may require government intervention if the market fails to produce this outcome.

Environmental accounting, satellite surveillance and criminalization, may be seen as institutional technofixes akin to Hardin's (1968) 'technical solutions' for resource degradation and scarcity, solutions which he saw as requiring '...a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality'.[12] If neither criminalization nor the market can offer a solution, what type of change may be required?

Seeing Ourselves In Nature, Nature In Ourselves: A Reconciliation Solution?

The change in values attempted by some legislation, from describing human action on private land as desirable to designating it as criminal, is a dramatic one. This change reflects a view that, problematically, extends beyond human actions that have negative consequences. Much of the current system of legislation, impacts only on those who have existing native vegetation remaining and does not impact upon those who have already cleared their land. Regrowth or offsets however, may become a condition for successful clearing applications in Victoria and New South Wales. Restoration orders could also be included as penalty for illegal land clearing in South Australia and New South Wales. The results of these restorative attempts have been argued to be merely gardens that are not really 'natural' because of their human origins (Elliot 1997). Benson (1999) refers to intentionally re-established areas as 'designer' ecosystems. While it is desirable that natural ecosystems not be viewed as 'renewable' to justify their destruction, it seems odd to discount human attempts to restore an environment that has been degraded by unsustainable management. According to the 'garden' view, humans can do no right. At its most extreme, the view would result in a policy of non-intervention even if this intervention is only to address the harm caused by past interference. Retention alone, like more formal reserve systems, may only offer the ad hoc preservation of vegetation in areas that have been historically too hard to clear or have proved unviable. For practical reasons it may never be possible to reserve or restore all ecosystems.[13] However, it would be irresponsible, given the present state of awareness, not to make the attempt at restoration, and unfair to require only those with un-cleared land to bear the full responsibility for reparation. The costs of sourcing, planting and ongoing management would make such ventures unfeasible for most private landowners and outside assistance would in all likelihood be essential.

Arguably, the question of whether environments that are intensively managed or where certain conditions for their development have been instigated by humans, are so divorced from nature that they are no longer part of nature, remains to be more cogently addressed.

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12 See Halsey (2004a:37) for an illuminating discussion of the effects technology has had on our ways of seeing and the limitations of these resultant ways of seeing and proposed techno-institutional fixes for human-induced environmental harm, see further Halsey, 2004b: 836.

13 Nor desirable to keep them like museum pieces.

Perhaps nature should not be so narrowly defined so as to exclude humanity, especially in Australia where many ecosystems may owe part of their evolution to Aboriginal land management practices such as firestick farming. Glazebrook (2003) argues that something natural may result in ecological restoration where humans work with rather than against nature.[14] There are some landscapes that may equally belong both to nature and to culture. Rose (1996:85) quotes an Australian Aboriginal woman as saying '(T)his earth has an Aboriginal culture inside'. It is possible that this perspective may be extended the arcadian or bucolic paradise created by a combination of human and nature, may not be just a product of the imagination. The harvest used to be seen as a time of richness and of bounty, the fruits of the earth and of human toil to be celebrated. The harvest, in some ways, is now seen as something that occurs at the expense of non-human nature: salinising and acidifying the soil, if not eroding it completely; destroying organisms rather than husbanding them; and making the environment more harsh and extreme rather than more habitable and hospitable.

How did this picture of agriculture as universal despoiler emerge? There have been many connections made between agriculture and desertification. Perhaps most portentously the crucible of agriculture, the Fertile Crescent, no longer supports the production that fostered its name. Human mismanagement on a gross scale continues to be evidenced by excessive and dangerous agrichemical inputs, the declining diversity in agricultural landscapes and cultivars, poor animal welfare and the effects of unsustainable practices such as excessive water use and overstocking. Given this track record it is not surprising that there are serious concerns surrounding genetically modified foods. In Australia, unsustainable land management practices have caused dramatic declines in water quantity and quality, salinisation, soil acidification, deterioration of soil structure and erosion. This has led to billions of dollars in lost productivity. The cost of reparation in Australia has been estimated to be in the billion dollar range and in some cases farm retirement and industry restructuring have been recommended (Madden et al. 2000; Wentworth Group 2002). However, without resorting to romanticism, there are alternative stories, for example in Southern Australia there is considerable evidence that some pastoral areas have developed a self-supporting nature of their own (Smith 2000). Humans have developed sustainable systems, sometimes even within industrialised agriculture, and agriculture may support and be part of natural systems and thus part of nature (Altieri 1987). Agroecologists view people as part of evolved ecosystems that have both natural and human elements. The challenge we face at present is to overcome the human-nature dichotomy. It may be time to acknowledge that some landscapes modified by humans, whether by First Peoples, by activities intended to restore nature or perhaps by agriculture may be accepted not only as part of nature but as essential for securing our environmental future. Ongoing management of areas that are a combination of culture and nature may then be recognised as a valuable contribution.

Conclusion

The early images from space were of the whole Earth, we were all 'in it together'. Satellite imagery has revealed extensive information about land cover change. The use of satellite imagery has made the extent of land clearance blatantly apparent, exposing the degree of land clearance and the degree of non-compliance with land clearance prohibitions. However, what is appreciated about the imagery owes much to the values held by the observer. The processing of satellite imagery categorises the landscape so that it is split between agriculture defined by private tenure, commercial production, human occupation

14 Glazebrook, T (2003) 'Art or Nature? Aristotle, Restoration Ecology, and Flowforms,' *Ethics and the Environment*, vol 8, no 1, pp 22–36.

and impact, and nature defined by public tenure, preservation and the exclusion of humans. There is great force and naming-power in categorisation, which tells us what something is and in doing so implies what it is not and therefore important complexities may be concealed. By dividing the landscape according to tenure and function, satellite imagery alternatively commodifies and criminalises, and both ways of seeing fail to recognise other functions and values. By introducing conservation as a function of private land management, land clearance regulations have crossed this tenure boundary while maintaining the division between the natural and the human. However, the divide between human and nature is an artificial one, since areas that have been preserved in some way from human impact often have a history (and prehistory) of human influence and are presently maintained by humans. The divide also fails to recognise that natural landscapes are productive: they produce much that we consume and much that is necessary for ecosystem functioning. These same functions may be performed in private areas where humans live as part of agricultural systems or in rehabilitated ecosystems that operate according to ecological principles. In some environments the human elements of the landscape may be indistinguishable from the parts considered 'natural'. The human-nature demarcation has allowed for the homelands of First Peoples to be redefined as wilderness. While they have been held up as trophies of so-called pristine nature, untouched by human hand, they have nevertheless been used both before and after the act of reservation. Indeed in reservation they have been described as commodities that have been saved from being consumed by humanity. Few measures however, have recognised any use of nature which is independent of human benefit even when benefits have been more broadly considered so as to include ecosystem services. Arguably, we need to go beyond seeing the environment, whether intensively modified or 'natural', as merely a factory for products that humans can consume and we need to see humans as more than mere consumers or criminals.

Ecocentric policies, such as the Commonwealth of Australia's Biodiversity Strategy (1996) and the Victorian Government's Native Vegetation Management Framework: A Framework for Action (2002), recognise the intrinsic value of native vegetation. However the message contained here may be based on a view that nature and humans are distinct entities with interests of their own that are inevitably in conflict. Seeing landscapes as either dichotomies of wilderness versus production or wilderness versus destruction devalues the complex human-nature relationship. One way of recognising the productive value in natural systems as well as the natural value of agricultural systems, is environmental accounting. This, however, still serves only to emphasise consumption and to commoditise. It provides a price to be exchanged between a provider and a buyer. Labelling human and nature in this way and denying commensuration of other values in dollar terms, blocks other ways of seeing, for example from seeing ourselves as a part of, rather than apart from, nature.

Satellite surveillance may entrench existing ways of seeing the human-nature relationship, for example seeing the landscape as a consumable. It may also reinforce the wilderness boundary that exists between most conservation and production, that is the conception of a division between 'virgin' land unspoiled by human action and that which is a victim of, rather than being improved by, human action. Inadequate conceptions of the human element in landscapes are presently circumscribing the development of effective institutional responses to land clearance and land management. Without new ways of envisaging the relationship between humans and nature it is unlikely that any attempt to criminalise land clearance behaviour will be seen as a just and effective solution.

Satellites may be used to unmask the material consumption of the landscape and to define it as criminal. However, to do so may conceal, as do the land clearance regulations themselves, other relationships that exist between humans and nature. The fact that humans

are themselves at risk because they have caused their environments to be at risk, is a potent signal of these relationships. Halsey (2004b: 838) discusses the work of Deleuze and Guittari and argues that 'it is questionable whether it is possible to logically speak of "the biotic community" as something existing externally to the happenings of "humanity". Perhaps a more productive approach would be to say that there are numerous and heterogenous interfaces between bodies and practices...'.

Defining human activity in the landscape as simply criminal, destructive, consumptive or unnatural, simply because it is human, ignores the fact that human-modification has not always compromised or been at the expense of the natural values of landscapes, just as nature is not always beneficial. The culture of humans in any landscape plays an important role in determining the environmental outcomes of that landscape and therefore solutions to mismanagement will need to be socially sustainable to be environmentally sustainable. This may not be easily achieved if the role of humans is restricted to that of consumer, despoiler or criminal. Since 1872 the effective boundaries of Yellowstone National Park have been extended to cover the natural ranges of wildlife rather than just scenic values for humans. In Australia land clearance regulation has blurred the line between private-and-production and public-and-preservation. The boundaries may have to be obscured even further for a truer picture of our role and interconnection with nature to emerge. Should we not extend the boundaries of nature to include ourselves? In division we obscure the humanity in the 'other' (nature) as well as the 'other' in ourselves.

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