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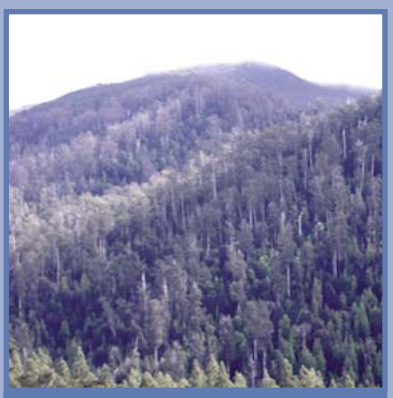

A Global Comparison of Forest Practice Policies Using Tasmania as a Constant Case

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Background and Objectives

The Program on Forest Policy and Governance at Yale University's School of Forestry and Environmental Studies was commissioned by the Forest and Forest Industry Council of Tasmania to undertake this study. The purpose of the Program is to conduct analytical research, teaching and outreach addressing critical global and domestic forest policy issues. The Program takes no position on the appropriateness of any particular policy approach. Instead, it conducts a range of research projects designed to enhance transparency, dialogue and learning about global and domestic forestry challenges. This continues to be a working document and we welcome further feedback.

Executive Summary

This report systematically compares environmental forest practice policies in the Australian State of Tasmania with the policies of thirty-eight other jurisdictions, from twenty countries worldwide. The jurisdictions included in this study were selected on the basis of their forest extent and/or importance to global forest products trade.

The comparison was conducted using a standardized template, developed by Cashore and McDermott (2004), that compares policies across five key forest practices criteria. These criteria are: riparian zone management, clearcut size, road culverts and decommissioning, reforestation requirements, and annual allowable cut. Policies are analyzed according to two measures. The first measure involves the classification of policies by level of prescriptiveness. Policy classification captures the structure of the policy requirements, but not the content. The second measure explores policy content through an assessment of "performance thresholds" i.e. specific on-the-ground forest management prescriptions. In addition, the report discusses approaches to plantation management, biodiversity protection, enforcement and compliance, and forest certification.

The primary focus of this study is on written policies rather than implementation; hence the report makes no attempt to link policy approach with environmental impact. Due to the limited scope of the analysis, the report is intended to inform, but not resolve, debates about how to best encourage environmental protection and promote sustainable forestry in Tasmania and elsewhere.

KEY CONCLUSIONS

Forest Practice Policies

General

Tasmania is unique among case study Organization for Economic Co-operation and Development (OECD) jurisdictions in applying the same forest practice policies to both public and private lands in regards to riparian buffers, clearcut size limits, reforestation and road building.

Policy prescriptiveness (policy structure)

- In comparison with North American case studies, Tasmania ranks as equally prescriptive as the western Canadian case studies, California, and the forests managed by the US Forest Service.
- Among the OECD countries outside of North America, Tasmania is the most prescriptive.
- The US Southeast and Portugal have the least prescriptive policies of any of the jurisdictions assessed.
- Amongst developing and emerging economy countries, Russia takes the most prescriptive approach, comparable to Tasmania's. However, other assessments (Esty and Cornelius 2002) suggest Russia has the least effective environmental governance system of any case study jurisdiction.

Performance thresholds (policy content)

- Tasmanian forest practice performance thresholds most closely resemble those of the western US and Canadian case studies.
- Tasmanian thresholds are generally less restrictive than those of the US Forest Service, New South Wales, and developing country case studies.

- The most restrictive threshold requirements are found in developing countries and countries in economic transition where, paradoxically, government enforcement capacity is lowest.

Plantation Policies

- Across all of our case studies, environmental protection policies related to plantations are either the same or less prescriptive than they are for natural forests. The most detailed plantation policies are found in Tasmania, the other Oceanic case studies, and South Africa.

- Tasmanania's forest practices requirements for plantations are generally similar to those for natural forests: they are more permissive only in the case of clearcut size on slopes less than 20 degrees.

Biodiversity Protection Policies – Species at Risk and Protected Areas

Tasmanian regulations protecting endangered species are among the most prescriptive of our case study countries. Species at risk, including vertebrate and invertebrate animals, vascular plants, and lower plants such as mosses and lichens, as well as their habitats, are afforded special protection.

In regards to protected areas, there is a lack of reliable global-scale data, as well as a lack of sufficient data at the sub-national level, that would allow an accurate comparison of Tasmania with other case study jurisdictions. The national-level World Database on Protected Areas provides the best available data as of 2006 (WDPA Consortium 2006). According to this database and Tasmanian records, in 2006 Tasmania had more area protected under IUCN categories I (strict nature preserves, wilderness areas) and II (national parks) than any of the case study countries (including Australia, as a whole). Subsequent Tasmanian forest policy agreements have protected additional areas from timber harvest, mostly under IUCN categories III-VI (special and/or sustainable use natural areas). Across all categories of formal reserve, 40.2% of Tasmania's land area was protected in 2006.

Outside of protected areas, Tasmanian forest policy allows for the conversion of natural forest to plantation across 5% of its 1996 natural forest cover. This conversion, which is limited in extent within each forest community, is to be phased out on public lands by 2010 and on private lands by 2015. Among the other cases study jurisdictions, such conversion is allowed in many private forests but is often prohibited in public forests. Concerns over the environmental impacts of natural forest conversion has generated a great deal of controversy within, and outside of, Australia.

Enforcement Policies

Tasmania is unusual amongst the case study comparators in applying and implementing the same forest practices system across all land tenures. The enforcement of Tasmanian forest practice regulations is governed by the Forest Practices Authority (FPA; formerly the Forest Practices Board). The FPA oversees both random and routine audits on both public and private tenures. This type of systematic auditing is not uncommon among developed country comparators. However, Tasmania takes a uniquely co-regulatory approach, involving state oversight of forest practice audits conducted by accredited "Forest Practice Officers". Routine audits are mandatory upon completion of all forestry operations. They must be conducted by Forest Practice Officers, who may also be employees of the company audited. Independent random audits are conducted by the FPA using third party Officers and FPA staff.

In most marked contrast to Tasmania amongst case study comparators, forest practice regulations on private land in the US Southeast and Portugal are primarily voluntary, and state monitoring efforts may not be backed by enforcement mechanisms. In the case of lesser-developed case study countries, legislation may allow for strict enforcement, but governments often lack capacity to consistently enforce their environmental policies.

Forest certification

Forest certification continues to be a strongly contested policy arena. In Australia, there are active protagonists of both the globally focused and environmental group-initiated Forest Stewardship Council (FSC), and the

nationally focused and domestically initiated (but now PEFC-endorsed) Australian Forestry Standard (AFS). The FSC's rule precluding certification of plantations on forest lands converted after November 1994 is a difference between the two programs, which de jure makes significant areas of plantation owned by key companies in Tasmania ineligible for FSC certification. Some Australian plantation forestry firms have sought and secured FSC certification; conversely, many Australian state forestry agencies and other firms, including those which harvest the majority of wood from Tasmanian public and private lands, have sought and secured certification under the AFS. Within Tasmania, as of June 2006, 63 hectares had been certified under the FSC and over 1.7 million hectares under the AFS.

Conclusions

This study's systematic classification and assessment of forest practices policies has revealed considerable variation across the case study jurisdictions. Tasmanian policies for public lands are among the five most consistently prescriptive of the case study public ownerships and among the three most consistently prescriptive of the case study private ownerships. Tasmanian performance thresholds are most comparable to those of western North America. The comparative effectiveness of Tasmania's policy approach in achieving environmental objectives is a subject for future research relating policy approach to forest management outcomes.

Introduction

In Tasmania as elsewhere, forestry firms, governments, and a wide range of concerned citizens and non-governmental organizations are facing a rapidly globalizing forest economy that is complex, uncertain, and highly contentious. The targeting of wood products from specific regions and individual firms is on the rise, new and conflicting modes of private authority are vying to redefine the rules of global forest trade, international forums and policy deliberations have proliferated, and a range of governmental and non-governmental organizations are demanding verification of the legality of product sources.

There is at the same time a lack of transparency regarding the content of existing forest policies and the degree to which different jurisdictions have thus far tailored their policies to address the issues of growing global concern. The purpose of this report, therefore, is to promote policy learning and reduce uncertainty for governmental agencies, forestry firms, and other forestry stakeholders by rigorously comparing just what Tasmania and other key forestry jurisdictions require of firms operating within their own borders. While individual scholars and practitioners have considerable knowledge about specific countries or regions, no published studies have systematically compared different domestic forest policy requirements across the globe.

This report will provide a policy comparison between Tasmania and 38 other jurisdictions worldwide. The comparison includes the description and classification of each jurisdiction's policy approach to key forest practices criteria, as well as quantitative comparisons of specific environmental performance requirements. Process requirements are covered only as they directly relate to the substantive forest practice issues addressed.

In addition to the highly standardized comparison of specific forest practice criteria, the report also addresses several broad, overarching policy issues. These include plantation management, the protection of biodiversity, and the institutions of forest law enforcement and governance. Enforcement and governace are covered through the examination of state-based regulatory structures as well as non-state environmental governance through forest certification.

This study's focus is on written rules and formalized enforcement procedures, rather than on-the-ground measurement of implementation. The clarification of what policies are already in place, however, paves the way for more systematic future research into the relationship between written policies and on-the-ground achievement of sustainable forest management.

The report draws on existing work by Cashore and McDermott (Cashore and McDermott 2004). The reader looking for further, in-depth information on the 38 case studies outside of Tasmania is encouraged to access the larger report.

Forests and Forestry in Tasmania – A Brief Overview

The Australian State of Tasmania is an island of 68,331 square kilometers[1] located 240 km. off the southeast coast of mainland Australia. The state's topography is rugged and mountainous, and the climate is cool-temperate with high rainfall in some areas, especially in the western region (up to 3200 mm. average annual rainfall) (AUS Bureau of Meteorology 2007). About half of Tasmania is forested, with eco-types ranging from temperate rainforest to wet and dry eucalypt and mixed forests. A diversity of eucalypt and acacia species predominate, interspersed with other temperate trees and some native conifers (CSIRO 1997).

Over the two-hundred and nineteen years since European settlement, an estimated 23% of Tasmania's native vegetation has been cleared (RPDC 2005), including about 45% of the wet and dry eucalypt forests. The greatest losses have occurred in grasslands and grassy woodlands which have been cleared for grazing and agriculture (RPDC 2003; WWF Australia 2004). The rate of forest loss has recently declined along with changing economic conditions and a shift in government priorities. By 2006, approximately 42% of Tasmania's remaining forest area had been placed under some form of conservation reserve (DPIW and Forestry Tasmania unpublished), and additional forest protected as commercial forest within Tasmania's Permanent Forest Estate.[2] The vast majority of the conservation reserves

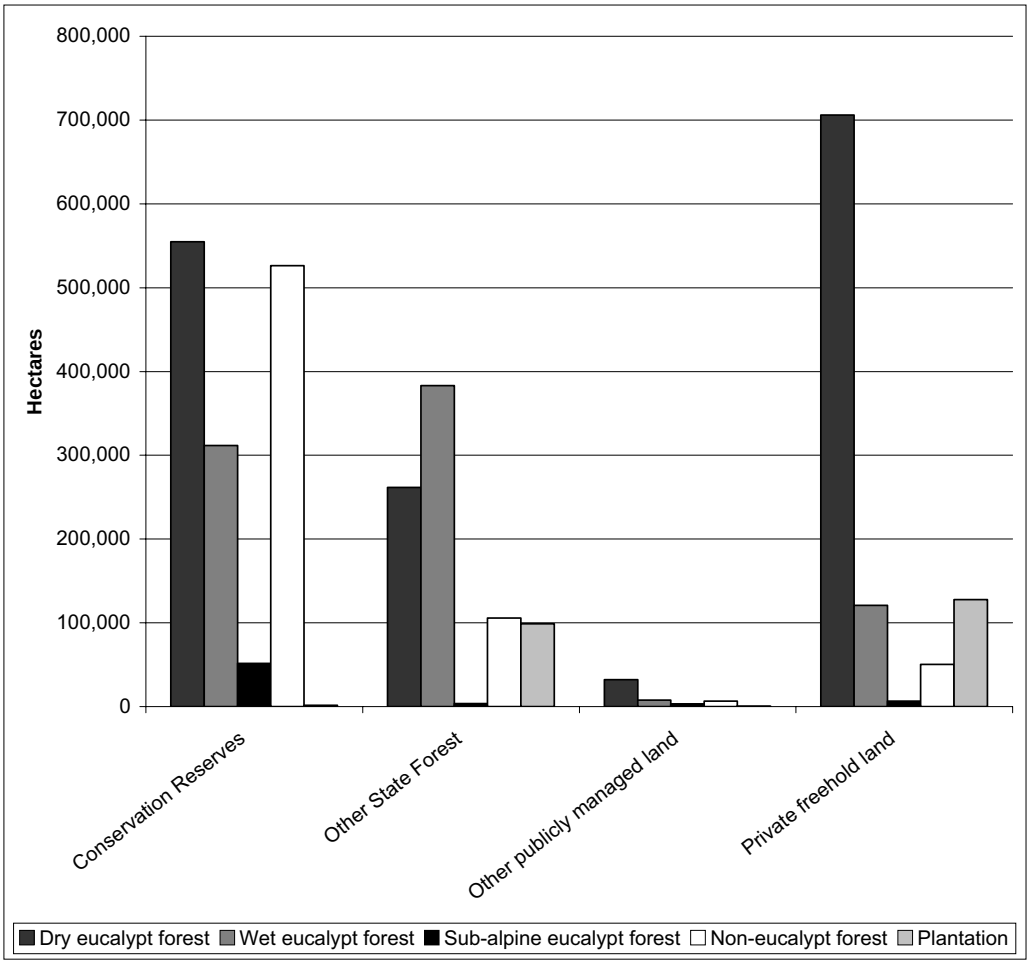

Figure 1. Forestland distribution by land ownership, forest type, and reserve status in 2006

[1] Tasmania is the smallest of the Australian states, roughly equaling the size of West Virginia or Scotland.

[2] Forestry Tasmania and the DPIW calculate the % reserve system based on a total land area of 68,100 km^2., a figure which excludes estuaries and other land below mean high water mark (personal communication w/ Penny Wells, Director of Policy and Projects, DPIW; Nov. 30, 2006.

are located on public lands, while unreserved forestland ownership is divided nearly evenly between public and private. Figure 1 illustrates the distribution of forestlands across ownerships, forest types, and reserve status as of 2006.

Figure 1 reveals differences in the distribution of wet and non-eucalypt forests between public and private lands, as well as in the proportion of each forest type covered by conservation reserves. The majority of wet eucalypt, non-eucalypt, and sub-alpine forests are located on public lands, while dry eucalypt are more evenly distributed across public and private lands. Across both land ownership types, conservation reserves cover 38% of the wet eucalypt and 36% of the dry eucalypt forests, roughly 76% of the non-eucalypt forests, and 79% of the sub-alpine forests.

As a whole, Tasmania's per capita forest area is high in comparison to most of the jurisdictions covered in this report, with a total state population of about 487,000 (Jackson 2005). The forest sector provides significant employment opportunities for the state's residents, and between 1995 and 2000 was responsible for approximately 18% of all manufacturing jobs (FPB 2002).[3]

In regards to total wood production, Tasmania leads the Australian states and territories in pulpwood harvests from both public and private native forests, while ranking fourth in the production of sawlogs and veneer (DAFF 2003a). In addition, Tasmania's plantation forests are growing rapidly in size and economic importance (Parsons, Gavran, and Gerrard 2004).

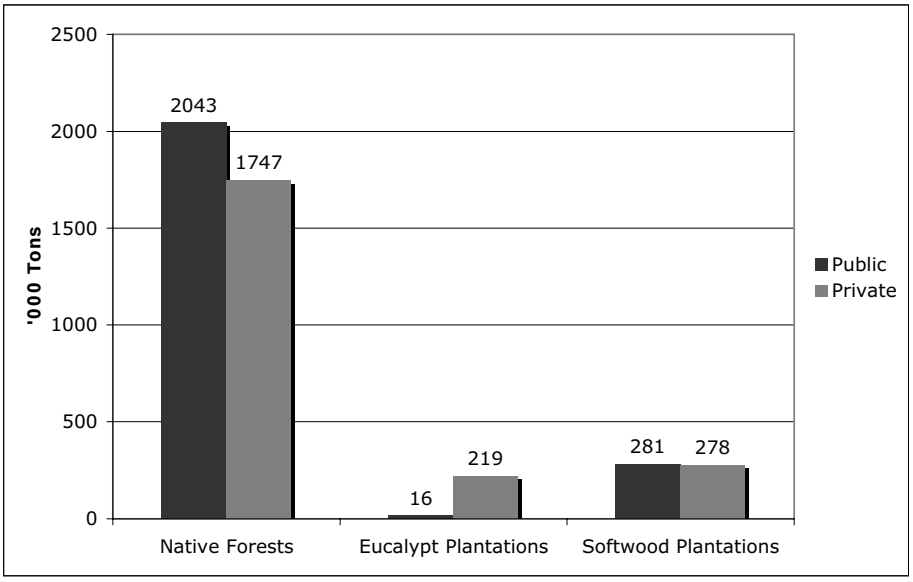

Figure 2. Tasmanian pulpwood harvest, 1996-2001 average

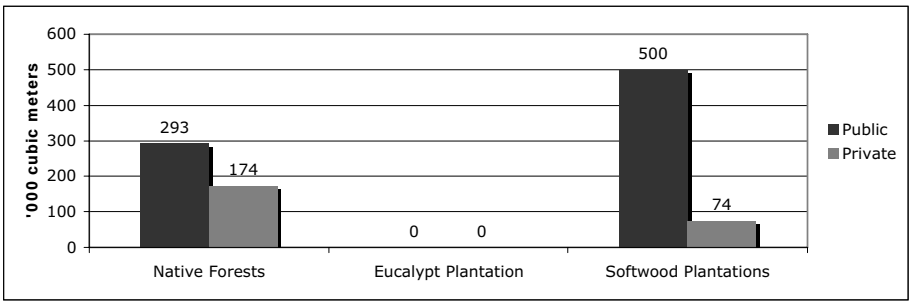

Figure 3. Tasmanian sawlog and veneer harvest, 1996-2001 average. Source: (FPB 2002: 50)

[3] Total manufacturing employment accounted for about 12% of employment in Tasmania in 1996 and 11.5% in 2001. DIER. 2006. Employment [website]. Department of Infrastructure, Energy and Resources, June 7, 2006 2006 [cited December 18 2006]. Available from http://www.dier.tas.gov.au/forests/rural_land2/employment.

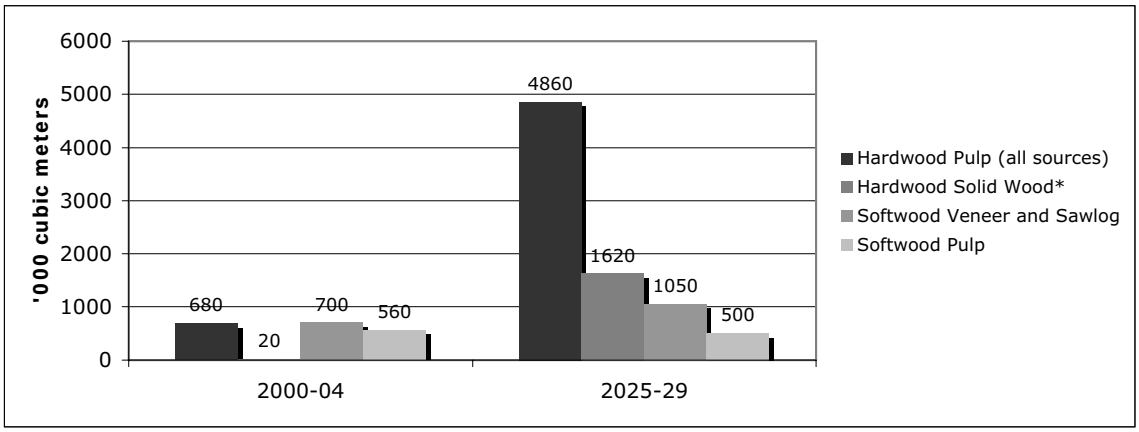

Figure 4. Projected yields for all Tasmanian plantations in five-year production classes. Source (FPB 2002: 48)

*Solid Wood is principally the non pulpwood product of the tree that may be valuable for a variety of uses, including rotary peeling or sawing.

Both the Tasmanian State Government and the Australian Government have played active roles in promoting the further development of Tasmania's plantation resource. In line with government policy, plantation production is projected to increase dramatically over the next twenty years due to an expansion in area planted and a rise in the average age class of existing plantations (Australia and Tasmania 2005b; Plantations 2020 2002). The majority of this expansion will occur in eucalypt hardwood plantations that are owned privately or as part of private-public joint ventures (Parsons, Gavran, and Gerrard 2004).

Historically, forest policy in Tasmania has been largely developed at the state level. The state's first major piece of forestry legislation was the 1920 Forestry Act. This Act, though it has since undergone many amendments, remains in effect today, and contains a core requirement that state-owned forests produce a minimum annual harvest of eucalypt sawlogs and veneer.

More recently, Tasmania became the first of the Australian states and territories to develop and adopt detailed environmental forest practice regulations. The 1985 Forest Practices Act provides a consolidated legal framework for this regulatory regime. The Forest Practices Act designates the Forest Practices Board (now the Forest Practices Authority (FPA)) as the governing body responsible to carry out its mandates. The Act also outlines forest planning requirements from the forest to state level. The Act furthermore requires the development and implementation of a Forest Practices Code, providing detailed forest practice requirements applicable to both public and private forestlands. The first Code was established in 1987, revised in 1993, and revised again in 2000. The Code is supported by a number of technical guides and planning manuals covering areas such as flora, fauna, geomorphology, soils, cultural heritage, visual landscape, silviculture, and fire management (FPA 2006).

Since the 1980s, the Australian Government has played an increasing role in forest policy-making. In the 1990s, Regional Forest Agreements were developed as a vehicle for integrating national and international forestry priorities with state and local legislation. The Regional Forest Agreements (RFAs) are built in part around the international "Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests," that call for the balancing of economic, social, and environmental management priorities. Tasmania is covered by one RFA, signed in 1997. A supplementary agreement, referred to as the Tasmanian Community Forestry Agreement (TCFA), was added in 2005.

The content of the Tasmanian RFA and TCFA reflect the complex and often contentious history of natural resource management within both the state and the country as a whole (Dargavel 1995). The stated goals of the RFA and TCFA are to augment Australia's Comprehensive, Adequate, and Representative (CAR) reserve system through the protection of old growth forest and rainforest; accelerate industry growth; and ensure sustained regional employment (Australia and Tasmania 1997: 1; Australia and Tasmania 2005a). The primary strategy to achieve these goals is to balance an expanded reserve system with an increase in the area of plantation forest.

The RFA made provisions for the establishment of an additional 473,474 hectares (ha) of formal public reserve areas (RPDC 2002), and the supplementary TCFA added an additional 148,000 hectares of public land reserves, including 120,000 hectares of old growth forest (Australia and Tasmania 2005b). In addition, a commitment was made to "facilitate the voluntary participation by private landowners" in the protection of private lands (Australia and Tasmania 1997). Meanwhile clearfelling in state-owned old growth forests is to be reduced to no more than 20% of the oldgrowth harvest by 2010 (Australia and Tasmania 2005b).

The creation of additional protected areas has led to a potential decrease in the projected supply of high quality sawlogs. In order to meet the sustained yield requirements of the state's Forestry Act while continuing to address stated industry and employment goals, the TCFA calls for an increase in intensive plantation management. This latter objective is to be achieved, in part, through the conversion of native forests to plantation. Under the TCFA, the clearing and conversion of native forests is to be phased out on public lands by the year 2010 and on private lands by 2015. Conversion is also to be limited to no more than 5% of the 1996 native forest cover (Australia and Tasmania 2005b). The issue of native forest conversion is, for some groups, among the most controversial elements of these RFA and TCFA agreements (see, for example, (WWF Australia 2004)).

Methodology

A widespread awareness of the global impacts of forest practices has generated a plethora of policy research, from theoretical and empirical analyses of international forestry governance systems, to numerous single- and multiple- case studies (e.g. Gunningham and Sinclair 2002; Gunningham, Sinclair, and Grabosky 1998; Hoberg 2003; Howlett, Rayner, and Wellstead 2004; Humphreys 1996; Humphreys 1999; Rametsteiner and Simula 2003). Despite significant advances, especially regarding the analysis of the broader goals governing national forest policies, there has been surprisingly little work done on what Hall refers to as "policy settings" –i.e. the specifics of what regulations actually require.[4] This is an important gap for two reasons. First, without careful attention to the requirements of policy, it is hard to know just what national forest policies and goals might mean for on-the-ground forestry operations. Written policies mean little, however, if they are not implemented and enforced. This leads to the second reason for detailed policy analysis, which is to set the stage for systematic research on the enforcement and effectiveness of the policies identified. For this purpose, we have adapted Cashore's comparative policy framework (1997) to examine key pieces of existing forestry legislation currently in place in wood producing and consuming countries around the world.

The analytical tool used in this comparison is based on four broad categorizations of policy. The first two categories classify policy on the basis of its *structure*, distinguishing between: 1) policy that grants forest managers discretion in its application, labeled *discretionary*, and 2) policy that is *non-discretionary*. The second two policy categories focus on policy *method*, and consist of 1) policy that directly addresses forest management practices (e.g. the size of riparian buffers or limits on clearcutting), which we refer to as *substantive*; and 2) policy that outlines procedures that must be followed to address forest management concerns (e.g. planning requirements or the development of environmental management systems), which we refer to as *procedural*. Table 1 summarizes this policy classification system.

The classification system summarized in Table 1, in turn, yields the following matrix of four "ideal type" policy styles.

Structure	Approach
1) Discretionary	Rules encourage, but don't require, a course of action
2) Non-discretionary	Rules require a specific course of action.
Method	
1) Substantive	Rules address on-the-ground changes
2) Planning/ procedural	Rules address management systems, rather than on-the-ground actions

Table 1. Policy classification framework

[4] For an exception, see Cashore, Benjamin, and Michael Howlett. 2006. Behavioural Thresholds adn Institutional Rigidities As Explanations fo Punctuated Equilibrium Processes in Pacific Northwest Forest Policy Dynamics. In By Fits and Starts: Punctuated Equilibrium in US Environmental Policy edited by R. Repetto. New Haven, CT: Forthcoming in Spring Yale University Press.

	Discretionary	Non-discretionary
Procedural (systems-based)	*Procedural flexible*	*Procedural inflexible*
Substantive (performance-based)	*Policy specification flexible*	*Policy specification "stringent" (inflexible)*

Table 2. Matrix of four policy styles

The utility of the four "ideal type" policy styles creates a clearer picture of regulations that are otherwise too complex and confusing to facilitate analysis and dialogue. For the very same reasons that such "ideal type" classification approaches are important – i.e. they create clarity and transparency out of complexity—such classifications may not always accommodate the specifics of a given policy. For these reasons, following our review, we have added the term "mixed" to refer to those policies which a) include mandatory substantive requirements without precise, standardized thresholds (i.e. policies that allow for government discretion); and/or b) apply to only a limited geographic area. "Mixed" policies might include, for example, a policy requiring no harvest buffer zones without the provision of standardized buffer zone widths. Examples of geographically limited policies are clearcut size limits that apply only to certain forest types (for example, alpine forests or native loblolly pine forests).

This report applies the forest policy classification system to key forest policies in twenty different countries worldwide, with Tasmania as a baseline comparison. The case studies were selected from the major wood producing regions of the world on the basis of 1) greatest area of forest cover within their world region; and 2) highest monetary value of import/export trade in forest products within their world region. These selection criteria were chosen not only as indicators of importance to the global forest sector, but also due to the availability of comparable global-scale data within the FAO forestry database. In addition, the case studies of Chile, New Zealand, Portugal, Poland, and Latvia were added because of their importance to changing global wood markets.

Sub-national case studies were selected for countries that primarily govern forestry at the sub-national level. These sub-national cases were selected, in turn, on the basis of 1) high area of forest cover, and 2) large volume of wood products production. Table 3 provides a list of the 38 national and sub-national case study jurisdictions.

Case Study Country	Sub-national Case
Canada*	Alberta
	British Columbia (BC)
	Ontario
	Quebec
United States*	Alabama
	Alaska
	Arkansas
	California
	Georgia
	Idaho
	Louisiana
	Mississippi
	Montana
	North Carolina
	Oregon
	South Carolina
	Texas
	Virginia
	Washington
Germany	Bavaria
Finland	
Sweden	
Portugal	
Australia	New South Wales
	Tasmania
New Zealand	
Japan	
Latvia	
Poland	
Russian Federation	
Mexico	
Brazil	Amazon Basin
Chile	
India	Madhya Pradesh
Indonesia	
China	
South Africa	
Democratic Republic of Congo (DRC)	

Table 3. Case study jurisdictions

* Of the sub-national case studies, the Canadian provinces and the US states have thus far been the most thoroughly sampled. We would encourage future comparative work to apply similarly intensive sampling to Germany, Brazil, and India. A study including all forested Australian states and territories is currently underway.

Forest Practice Policies

This section contains an examination of policies, regulations, and guidelines in each of the case study countries, addressing five key variables relating to sustainable forest management: 1) riparian areas, 2) cutting rules (i.e. clearcutting, or other cutting rules relevant to tropical forestry), 3) road-building, 4) reforestation, and 5) the calculation of annual allowable cut (AAC) (i.e. harvest levels). Specific policy indicators have been identified for each of these variables to allow for precise, standardized comparison. For example, minimum buffer zone size was chosen as an indicator of a government's approach to riparian management and clearcut size limits as an indicator for policies governing harvest patterns. Legislation in each of these countries is compared with Tasmania, which serves as the "constant case comparison" sample in our global study.

In many countries, forest practice policies vary among land ownership types and between natural forests[5] and plantations[6]. For the sake of clarity and comparability, this section will focus on the policies governing natural forests within land ownership types that account for at least 20% of a jurisdiction's forest area and/or 20% of its total wood product production. Given the growing importance of plantations in Tasmania (as elsewhere), this report will also address plantation policies in a separate section.

The policies considered are those that apply generally across all forestlands of a given ownership type, or that contain a general set of environmental attributes. They do not include individualized requirements for named sites of environmental or social importance (such as the Ganges River or the Rio Grande).

The policies subject to standardized comparison are the written regulations in force in February 2004. As earlier stated, written regulations may or may not capture the norms of on-the-ground implementation. Furthermore, policy-making is a dynamic process and some rules may have changed since the 2004 cut-off date. Given the more detailed coverage of the Tasmanian case study, this report provides some discussion of implementation norms and policy change within Tasmania, while noting the need for similar research in other jurisdictions.

Riparian zone management (Indicator: Riparian buffer zone rules)

The protection of riparian areas is a central issue in many forest management debates. Given the widespread acceptance of buffer zones as a means to protect riparian habitat and water quality, this indicator provides a very useful snapshot of a government's policy approach, and the relative level of environmental restriction its policies entail for riparian zone management.

The comparison will examine two different types of riparian zone restrictions— no harvest buffer zones and special management buffer zones— as they apply to streams and rivers (lakes, ponds, wetlands and other more stationary water bodies are not included in the analysis). "No harvest buffer zones" are zones where timber harvest is prohibited within the buffer area. The simplicity of this requirement allows for *relatively* easy comparison across jurisdictions, although the diversity of stream classification systems adds some complication. Special management zones (SMZs) are zones where a limited form of timber harvest is allowed. The limitations on management in these zones vary considerably. For example, in some cases the SMZs are essentially machinery exclusion zones with no limits on harvest levels, whereas other SMZs may involve high levels of tree retention and numerous other management restrictions. Due to limited space and resources, this report addresses only the relative sizes, and not the specific management prescriptions of the case study SMZs, except in those cases where otherwise noted.

In Tasmania, riparian buffer zone requirements are established within the state's Forest Practices Code (2000). Unlike most other case study jurisdictions, the Code rules are the same for both public and privately

[5] The precise definition of "natural forests, as well as the terms used to describe it, varies between countries. Generally "natural forests", and its corollaries "native forests" or "indigenous forests", are relative terms referring to forests that have undergone less intensive silvicultural activities than "plantation forests" adn that consist of predominantly native species.

[6] This report adopts the 2001 FAO definition of "plantations". The FAO defines plantations as "forest stands established by planting and/or seeding in the process fo afforestation or reforestation. They are either of introduced species (all planted stands), or intensively managed stands of indigenous species, which meet all the following criteria: one or two species at planting, even age class, regular spacing" (FAO 2001).

owned forests. The Code outlines a series of quantitative threshold requirements that identify buffer areas in which no harvest is allowed, as well as SMZs where management activities are restricted. The stream classification system used to determine buffer zone widths is based on the size of the watershed or catchments area, its presence or absence on 1:100,000 topographical series maps, and the constancy of stream flow throughout all seasons. Table 4 provides a summary of the four stream classes used.

A 10-meter no harvest zone is required along the portions of large to moderately sized perennial streams that reside within catchments of at least 50 hectares (i.e. Class 1-3 streams). Mandatory SMZs are prescribed for an additional 10 to 30 meters from the stream depending on stream class. Among the management restrictions within the SMZs is a harvest limit of 30% canopy removal (FPB 2000:46).

The buffer zone policies for Class 4 streams, i.e. smaller catchments that flow "for part or all of the year on most years," include a 10-meter machinery exclusion zone (SMZs) (FPB 2000). In May of 2004, after the cut off date for our standardized policy comparison, new guidelines were released for the protection of Class 4 streams. These guidelines, which were developed as the result of ongoing research, added further restrictions based on detailed measures of slope and "soil erodibility" (FPA 2004).

In addition to these standard requirements based on stream class, Tasmania has enacted further restrictions on riparian management within two kilometers from a town water source. These include a 10 meter no-harvest zone on all streams, including the smallest size class, plus an additional 40 meter SMZ along larger streams.

The Tasmanian Code also includes a policy to retain "wildlife habitat strips" for the maintenance of habitat diversity. In this case, the Code uses the word "should" which is defined as indicating a desirable practice for which Forest Practice Officers can make exceptions if "acceptable environmental outcomes are achieved (FPB 2000)." Specifically, the policy for wildlife habitat strips states, "As a guide, strips of uncut forest 100-meter in width, based on streamside reserves but including links up slopes and across ridges to connect with watercourses in adjoining catchments, should be provided every 3-5 km (FPB 2000)." For the purposes of our standardized comparative framework, we classify this approach as "voluntary", since discretion is afforded to non-governmental Forest Practice Officers. However, it should be noted that the approach is less discretionary than a policy assigning full discretion to the licensee or private forest owner.

The interpretation and enforcement of these riparian policies may in some cases involve restrictions that exceed the standard written requirements. For example, there are reportedly no cases on state forest lands where harvesting has been conducted within 10 meters of a Class 3 stream, and it is common practice to establish no harvest buffers within SMZs on all Class 1-3 streams.[7] This apparent discrepancy between written rules and practice norms highlights the need for further research on implementation.

In terms of written policy approach, Tasmanian riparian policies include the most prescriptive type, i.e. policies that are mandatory and substantive, requiring specific on-the-ground action. However, as with all jurisdictions,

Class	Definition
Class 1	Rivers, lakes, artificial storages (other than farm dams), and tidal waters – generally those named on 1:100,000 topographical series maps.
Class 2	Creeks, streams, and other watercourses from the point where their catchments exceeds 100 ha.
Class 3	Watercourses carrying running water most of the year between the points where their catchments is from 50 to 100 ha.
Class 4	All other watercourses carrying water for part or all of the year for most years.

Table 4. Tasmanian stream classification system. Source: Forest Practices Board (2000). Forest Practices Code, Forest Practices Board, Hobart, Tasmania: pg. 56.

[7] Personal communication, Chris Mitchell, Forest Practices Authority, with Tim Leaman, Conservation Planner, Forestry Tasmania, July 2006.

policy application may be more or less restrictive than the written language implies, depending on the manner in which the policy is implemented and the frequency with which exceptions are granted.

Figure 5 provides a graphical comparison of Tasmanian riparian rules with those of other jurisdictions around the world, as of February 2004. We wish to emphasize that this standardized comparison portrays *written rules only*.

Of these case study jurisdictions, only Tasmanian policies and policies for public forests in New South Wales (NSW) include standardized, quantitative requirements for riparian buffer zone widths. All except one of the remaining jurisdictions require buffer zones

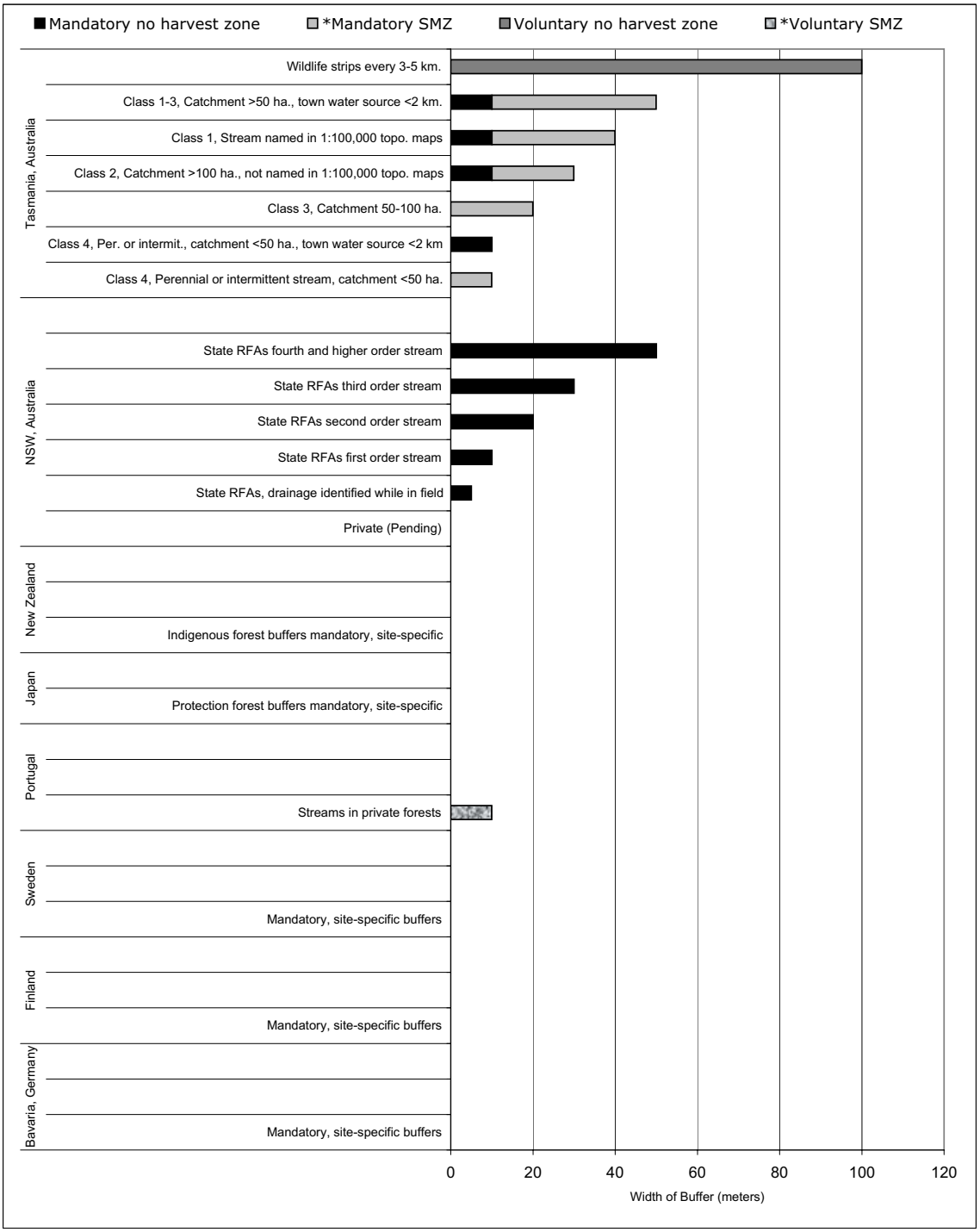

Figure 5. Riparian protection in Tasmania (public and private ownerships) and other OECD case study jurisdictions

to be established on a site-specific basis, a policy approach we define as "mixed" in that it contains elements of a mandatory approach but does not prescribe specific management practices. In New Zealand, riparian buffer zone management in indigenous forests includes a procedural element as well, requiring that buffer zone widths be established in comprehensive sustainable management plans.

The policies of NSW, which have also been established under Regional Forest Agreements (RFAs)[8], most closely resemble those of Tasmania. New South Wales however, utilizes a different stream classification system, different buffer zone widths, and different management prescriptions. The NSW "no harvest buffer zones" are wider than those codified in Tasmanian forest policy. Unlike Tasmania, NSW riparian policies for state lands have not applied to private lands, but this will change with the adoption of the Code of Practice for Private Native Forestry (NSW 2006).

Figure 6 compares Tasmanian riparian policies with those of the Pacific Coast of the US and Canada, a region that includes the most restrictive riparian policies of any of the developed country case studies.

One of the most striking observations to be made from Figure 6 is the sheer complexity of the Pacific Coast policies, involving numerous and diverse stream classifications. Criteria for classifying streams include diverse attributes such as width of stream, stream order, bank slope, rate of stream flow, soil type, presence or absence of fish or aquatic species, etc. This complexity makes a one-to-one comparison across jurisdictions challenging. Further on in this section, we provide some examples of more standardized comparisons based on the controlled variables of stream size and presence or absence of fish. Meanwhile, it is clear that all of these jurisdictions take a mandatory, substantive approach and that many include no harvest zones.

The Pacific Coast regulations stand in stark contrast to a number of other United States case study jurisdictions. Figure 7 summarizes our findings for Tasmania in comparison to US and Canadian case study jurisdictions located in other regions of the continent.

A key observation to be made from Figure 7 is that all of the US Southeastern states have established voluntary, substantive policies, making these the least prescriptive policies of any reviewed so far, other than Portugal. In contrast, Montana, Idaho, Alberta, Ontario, and Quebec have enacted mandatory, substantive buffer zone requirements. "No harvest zones" are mandated only in Tasmania and along salmon streams in Quebec.

We now turn to the less developed case study countries, including Eastern European economies in transition and developing nations. It is widely recognized that many lesser-developed countries have fewer resources and lower capacity to enforce whatever regulations they have put in place, as compared to wealthier nations. As explained earlier, however, this section does not address policy *effectiveness*, just the nominal policies themselves. In particular, any comparison of such policies with those of high capacity jurisdictions must not be taken as an indication of actual levels of environmental protection. Indeed, following Victor (1998), a reasonable hypothesis is that in those countries where compliance mechanisms are poor, there may be an inverse relationship between mandatory prescriptive rules and actual performance. With this caveat in mind, Figure 8 illustrates Tasmanian policies in comparison with those of Russia, Poland and Latvia.

Once again, differences in stream classification systems make precise comparisons difficult. Latvian and Russian classification systems are the most comparable, being largely based on the length of the watercourse. Russia mandates the largest SMZs in regards to very long rivers. Latvian SMZs on larger rivers are also considerably wider than those in Tasmania. Only the Latvian and Tasmanian policies include no harvest zones.

[8] At the time of writing the majority, but not all, of the State-owned natural forests in New South Wales were covered under Regional Forest Agreements (RFAs).

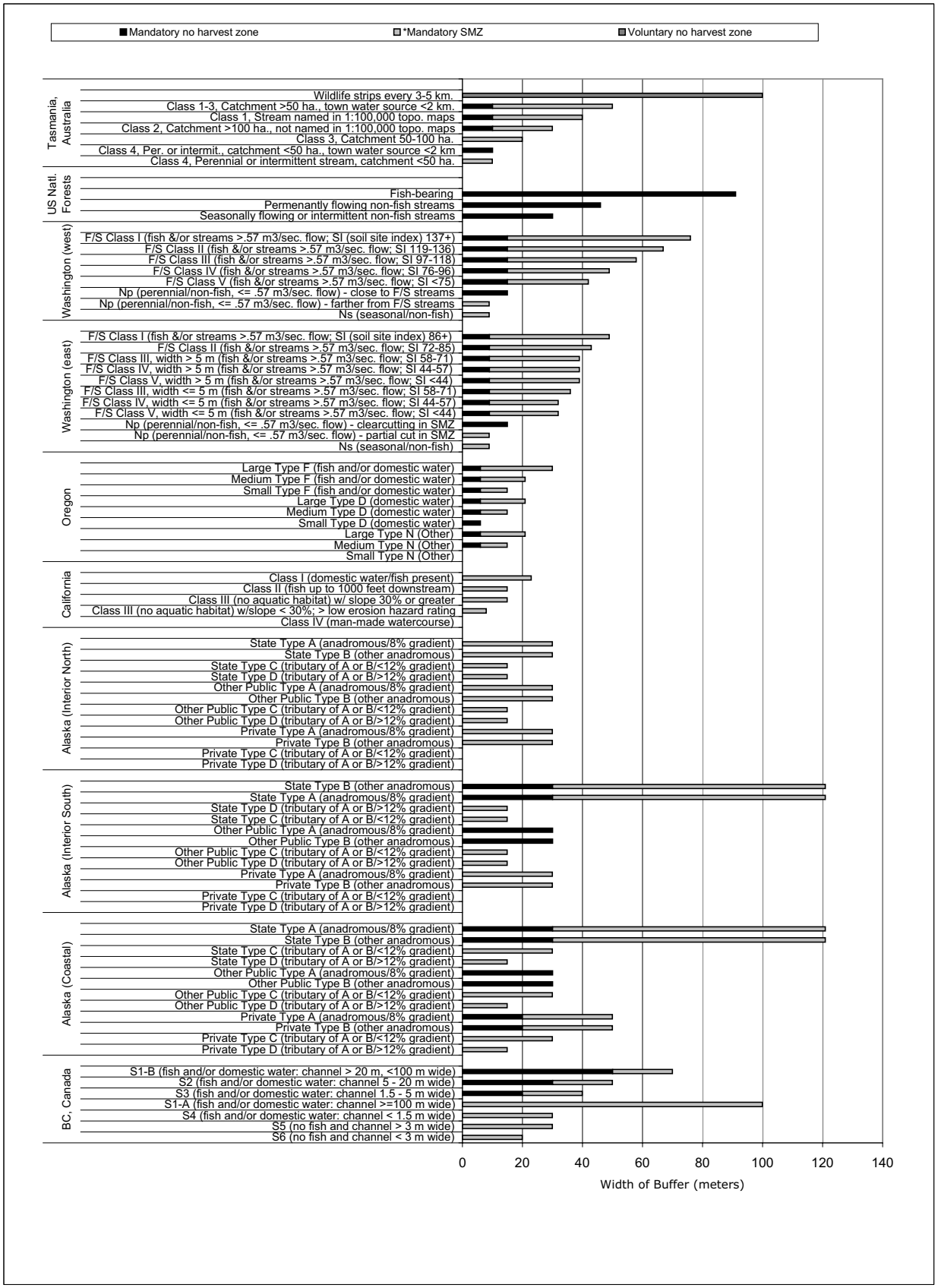

Figure 6. Riparian protection in Tasmania (public and private ownerships) and US states and Canadian provinces of the Pacific Coast

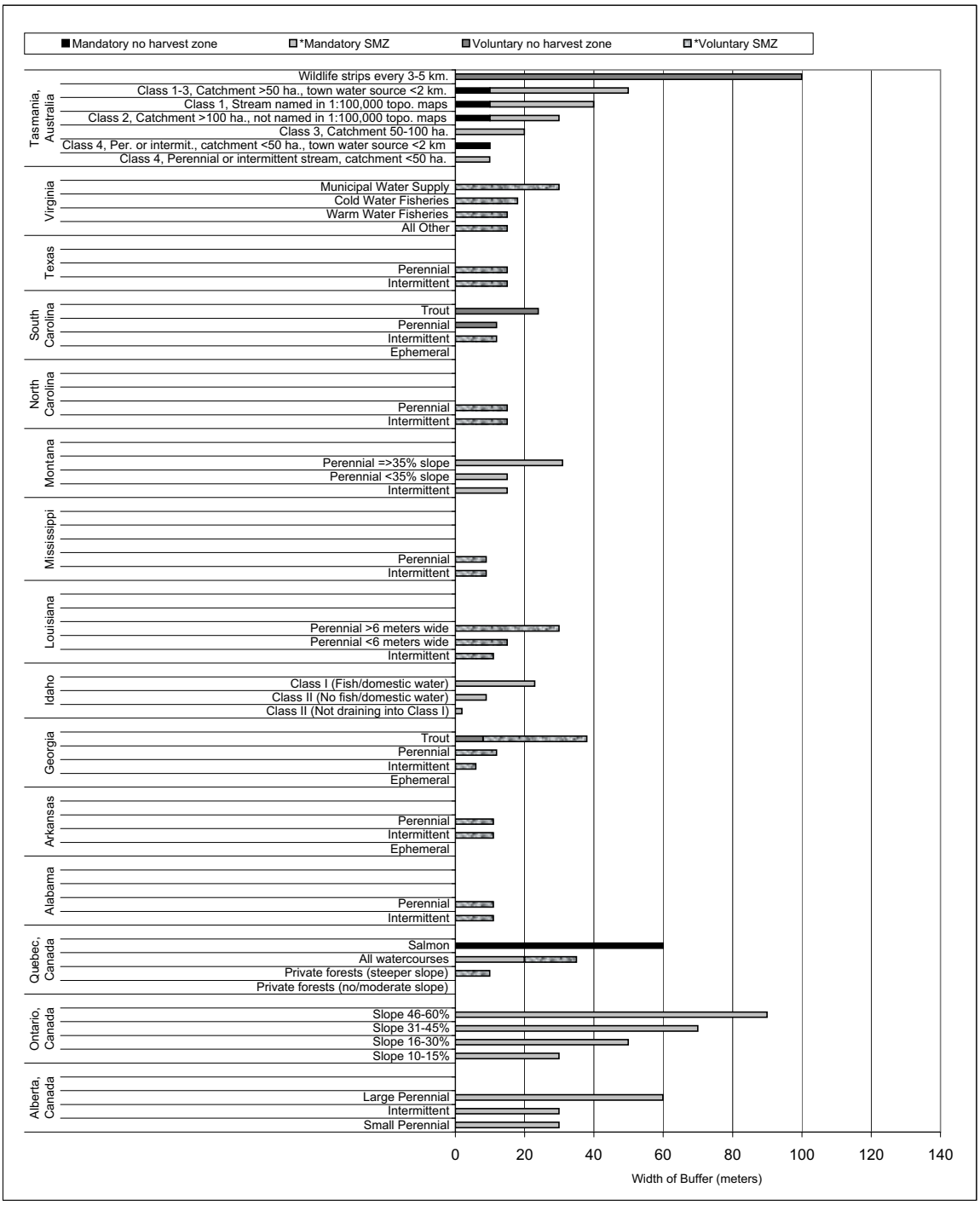

Figure 7. Riparian protection in Tasmania (public and private ownerships) and US states and Canadian provinces of the Pacific Coast

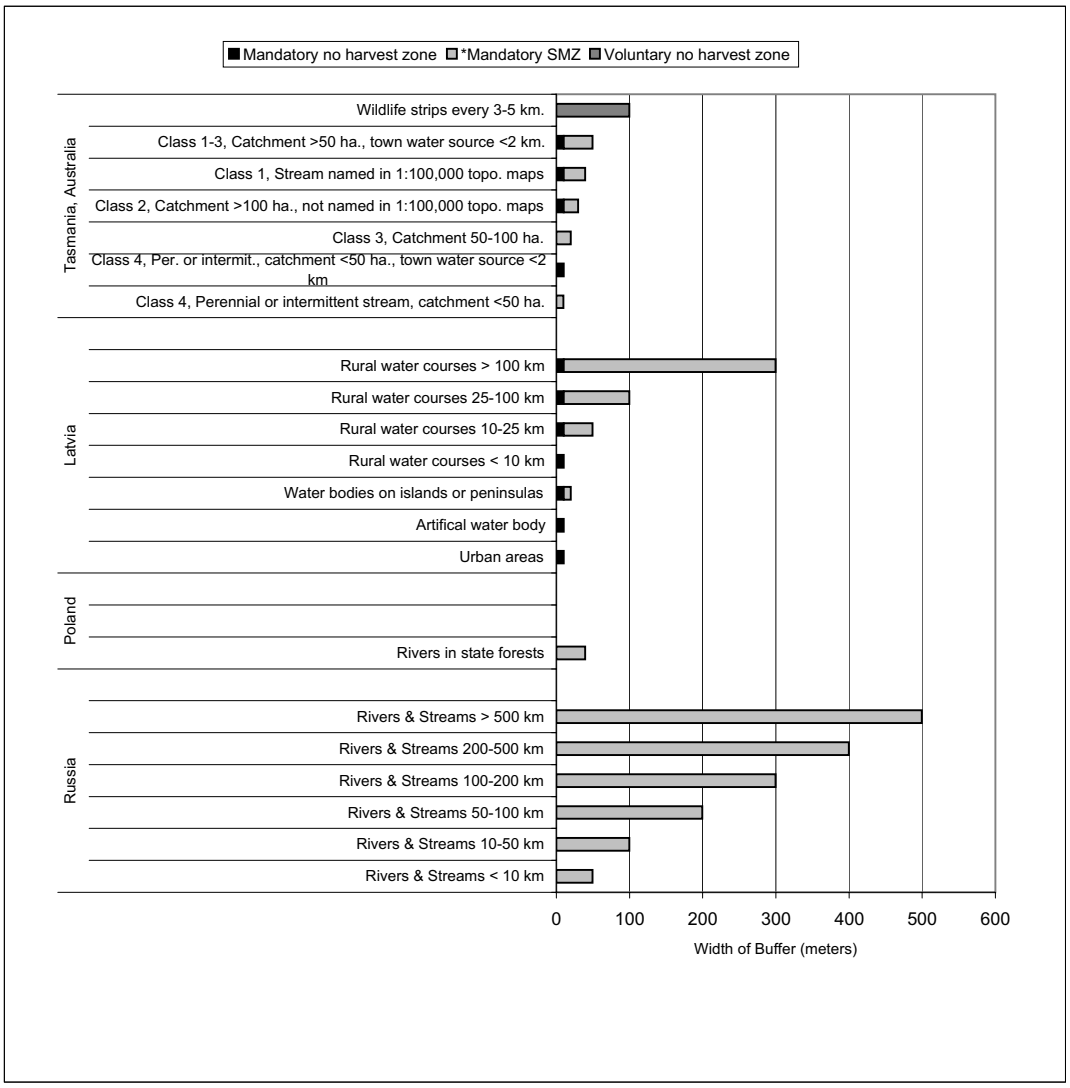

Figure 8. Riparian protection for Tasmania (public and private ownerships) compared with protection in transition economy case study jurisdictions

Finally, let us now turn to a comparison of Tasmanian policies with those of selected developing countries. As is clear from Figure 9, developing countries mandate the most ambitious no harvest zones. At the same time, these countries generally have the least capacity to consistently enforce the rules they have enacted (Esty and Cornelius 2002).

The Brazilian no harvest zones include the largest of any of our case study jurisdictions, followed by Chile in close second. A part of this variability could be explained by environmental differences. The Amazon region contains some of the world's largest rivers. As such, it may be inappropriate to compare Brazilian policies for very large streams with those of jurisdictions that lack watercourses that are the size, for example, of the Amazon River or Rio Negre. Nevertheless, the minimum no harvest zone applicable to any river in the Brazilian Amazon is 30 meters wide, or three times the width of no harvest zones for Tasmanian streams. Again, this by itself says nothing about the actual levels of protection provided for streams in the Brazilian Amazon or Tasmania, as this depends, in part, on whether the policies are consistently implemented.

Madhya Pradesh takes an entirely procedural approach to riparian buffer zone management, requiring that prescriptions be prepared through Working Plans at the sub-state level. South Africa's

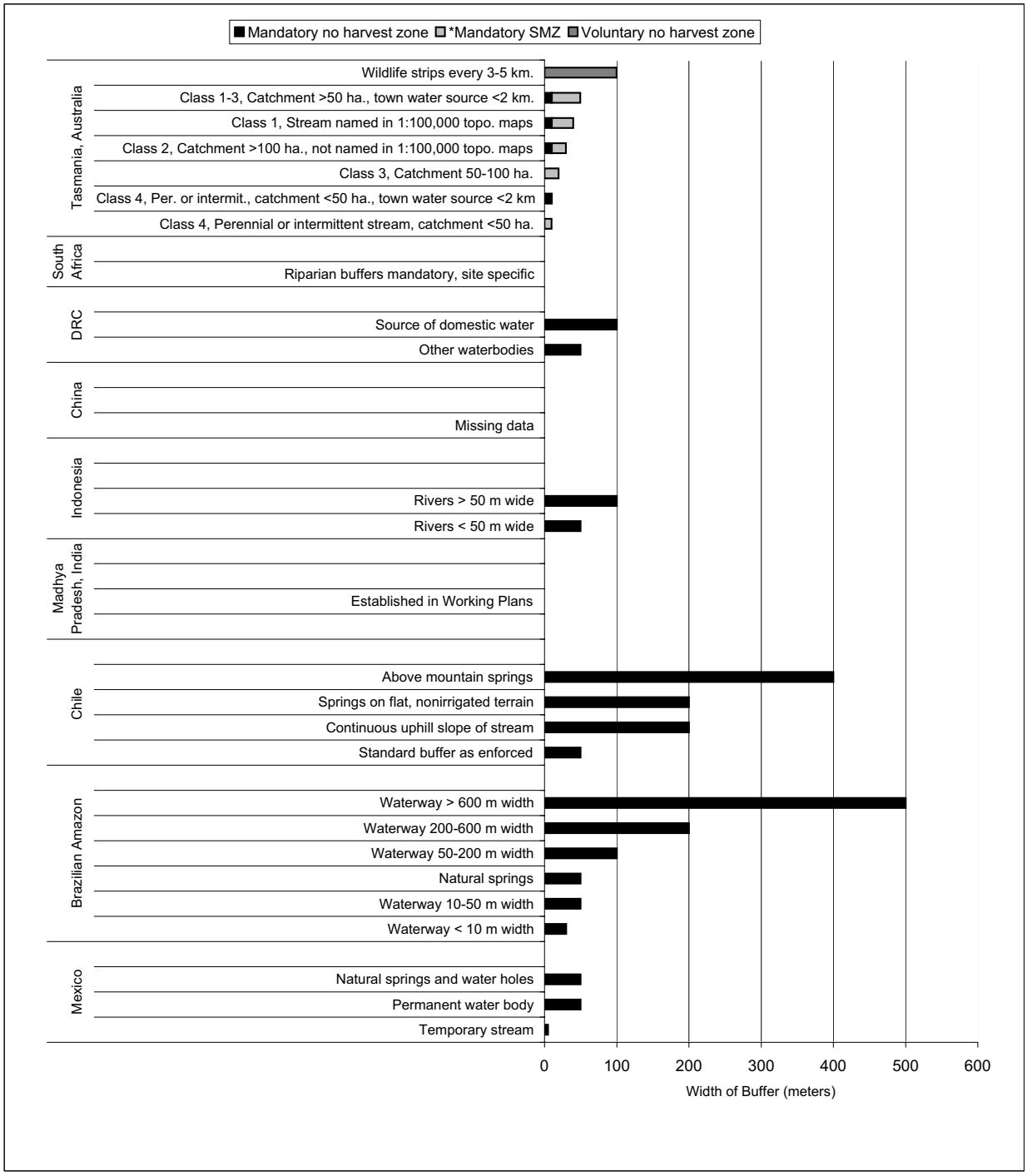

Figure 9. Riparian protection in Tasmania (public and private ownerships) compared with protection in developing country case study jurisdictions

approach is partly procedural. In "sensitive areas" in South Africa, including watercourses, natural forests are divided into "effective" and "ineffective" areas. Harvesting is prohibited in "ineffective areas". Management prescriptions are prepared for harvesting in effective areas in a manner that protects sensitive environmental habitats (personal communication, Pierre Ackerman, Faculty of Agriculture and Forestry, University of Stellenbosch, Feb. 24, 2004).

In sum, Figures 5-9 reveal a tremendous variety of riparian buffer zone policies, from the very complex to the uni-dimensional. While such a comparative approach has allowed for the delivery of a large amount

of information and qualitative discussion, further synthesis is needed to encapsulate key policy differences.

The application of our policy matrix, as illustrated in Figure 10, reveals that 53% of 38 case study jurisdictions , including Tasmania, have established mandatory, substantive (i.e. standardized threshold) requirements for buffer zone establishment. "Mixed" rules, requiring special management buffer zones but without standardized required widths, account for 18% of the case study jurisdictions[9]. Mandatory procedural rules characterize policies in 3% of the cases, and 26% of the cases have established voluntary guidelines.

The next step in our analysis was to conduct a standardized comparison of mandatory buffer zone sizes, by selecting standardized stream classification parameters. The focus in these comparisons was on "no harvest" buffer zones, since 1) no harvest zones represent the most stringent form of environmental protection (in all cases they are also accompanied by either prohibitions or major restrictions on road-building and the use of ground-disturbing equipment); and 2) special management zones vary dramatically in the types of management restrictions they entail, making standardized comparison difficult.

For large rivers of 50 meters in width or more, the Brazilian Amazon, Chile, and Indonesia have established the most stringent nominal requirements, with mandatory "no harvest" buffer zones ranging from 100 to 400 meters. Other large buffer zones applying to 50 meter wide rivers include the SMZs (i.e. zones where harvesting is allowed, but more restricted) along major rivers in Russia and Latvia. Zones on large rivers in these eastern European countries range from 100 to 500 meters in width[10].

While the transitional and developing countries have perhaps the most stringent nominal requirements for large rivers, they also have a lower capacity and/or less political will to enforce these policies. In the case of Chile, it is openly acknowledged that while the larger buffer zones remain in law, only 50-meter "no harvest" buffer zones are officially enforced (personal communication, Bello, CONAF, February 3, 2004). In practice, the 50 meter zones may be inconsistently enforced as well. The context of management outside of the buffer zones is also important to consider. In the case of Brazil, forest harvest regulations in the Amazon involve a mix of permanent reserve requirements along with legalized deforestation. Hence, more stringent protection of riparian corridors may be environmentally justified in order to offset the environmental impacts of deforestation outside of buffer areas.

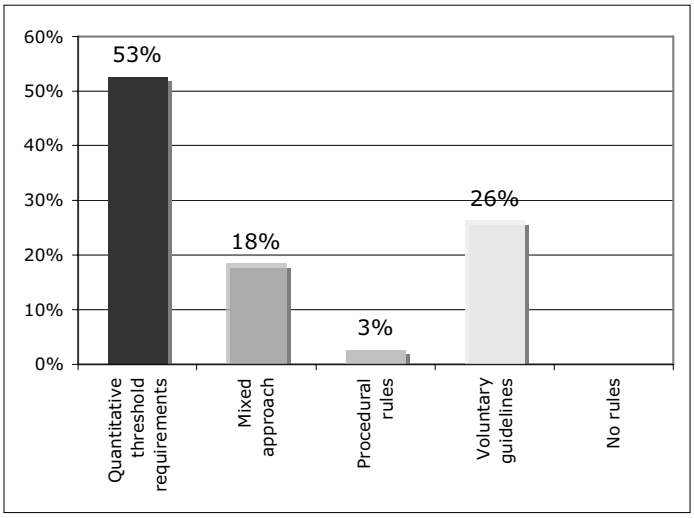

Figure 10. Policy approach of case study jurisdictions (%)

[9] Riparian rules for China are unavailable.
[10] The Eastern European countries classify rivers by length rather than width, however, making them less amenable to comparison with other regions.

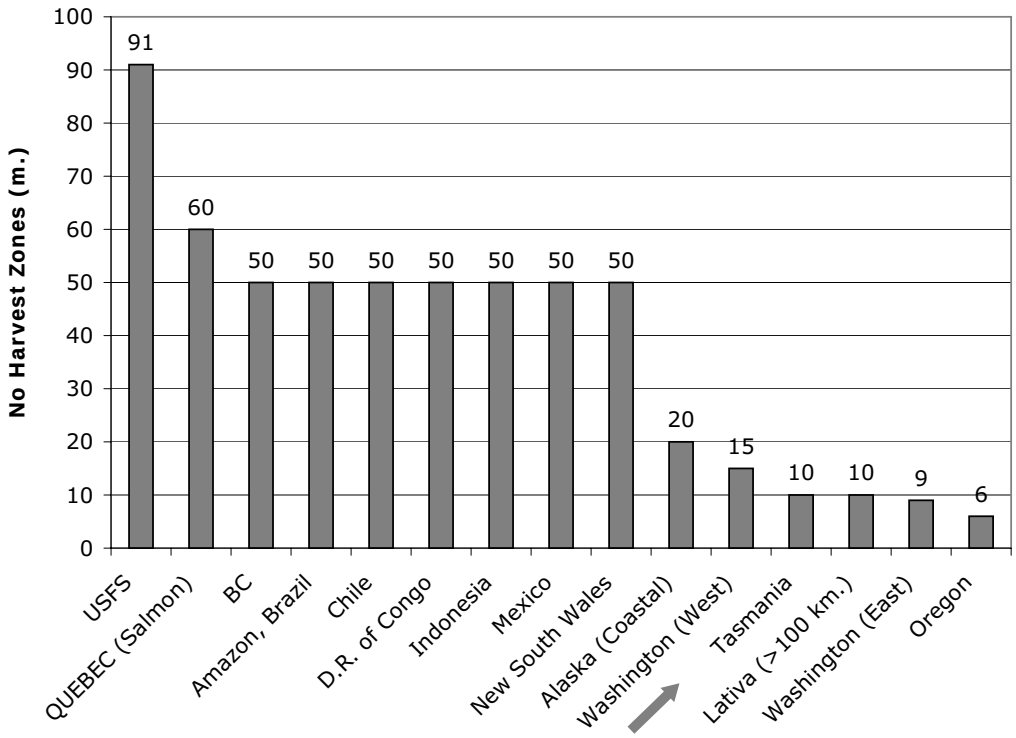

Figure 11. Riparian no harvest zones for 30 meter wide streams

If we change the parameters of comparison to medium-sized rivers, different global patterns emerge. For example, fish-bearing rivers that are 30 meters in width[11] and are located in natural forests are most stringently protected on United States Forest Service (USFS) lands. The USFS requires a 91-meter "no harvest" zone for all fish-bearing streams. In Quebec, a 60-meter "no harvest" zone is required along provincially listed salmon streams of all sizes. The third largest "no harvest" buffer zones for 30-meter wide rivers are the 50-meter zones required along British Columbian fish streams and along all natural streams in Mexico, the Brazilian Amazon, Chile, Indonesia, the Democratic Republic of Congo, and state forests in New South Wales. Tasmania mandates a 10-meter "no harvest" zone on such rivers, which places it between some western US states and Latvia in terms of its written policies. Figure 11 illustrates these findings.

For small, non fish-bearing streams ("Class 4" streams in Tasmania), however, only 5 developed country case studies - United States Forest Service, Idaho, Oregon, Washington, and New South Wales - among the 27 developed country cases require "no harvest" zones. In contrast, 5 of the 8 developing case study jurisdictions have established mandatory "no harvest" buffer requirements. In Mexico, Chile, Indonesia, and the Democratic Republic of Congo, the minimum requirement for riparian protection is 50 meters for all natural rivers, and in the Amazon it is 30 meters, regardless of either their size or the presence or absence of fish.

In general, countries participating in the Organization for Economic Co-operation and Development (OECD) have enacted less restrictive threshold requirements for riparian buffer zones than the transitional or developing country cases. In Germany, Finland, Sweden, New Zealand, and South Africa, special management zones are mandatory for "natural streams"; however, there are no standardized requirements governing buffer zone sizes. There are no mandatory provincial requirements for streamside buffer zones on Quebec private forestlands, nor are buffer zones required on private lands in the US Southeastern states, Portugal, and Japanese private, non-protection forests[12]. In contrast, the policies of Tasmania, NSW, British Columbia, Alaska, Washington, Oregon, and the US Forest Service include the most restrictive developed country

[11] We have chosen the 30-meter stream width simply for the purposes of standardized comparison of buffer zone regulations on medium-sized rivers.
[12] As stated earlier in this report, this study does not examine municipal laws or other laws enacted by local governments.

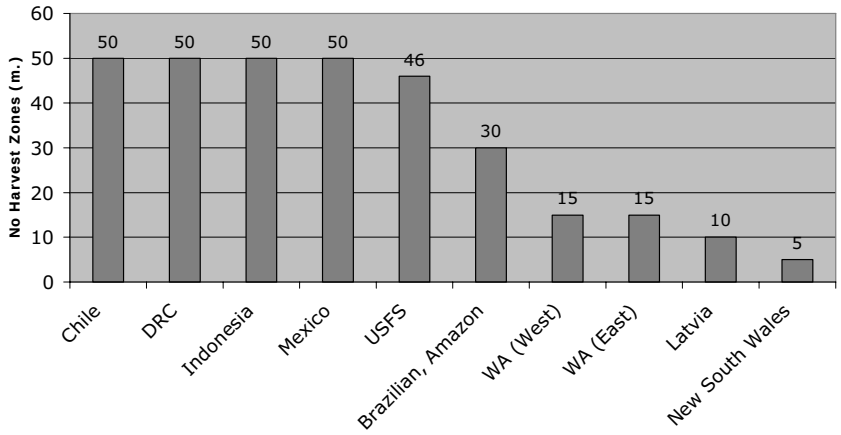

Figure 12. Riparian no harvest zones for 1-meter wide streams, no fish, not a domestic water source

* In Western Washington, riparian buffers along Np streams (i.e. non fish-bearing perennial streams whose rate of flow is less than or equal to 0.57 cubic meters per second (in other words streams that do not qualify as Washington "shoreline")) must measure a minimum of 15 meters in width. The proportion of the stream for which the no harvest rule applies depends on the distance of the Np stream from shoreline and/or fish-bearing streams.
* In Eastern Washington, 15-meter no harvest zones are required along a portion of Np streams when clearcutting is used within the riparian special management zone.

requirements, and they are the only such jurisdictions to have established no harvest zones.

The extent of variation in buffer zone sizes across all case study jurisdictions is itself worthy of note. This variation likely reflects both the diversity of environments represented and scientific debate about the adequacy of different buffer zone sizes and management restrictions. While there is general agreement about the need to restrict land use within riparian zones, it seems more difficult to generalize about the specifics of those restrictions (Belsky, Matzke, and Uselman 1999; Croke and Hairsine 2001; Kauffman and Krueger 1984; Parkyn et al. 2003; Quinn et al. 1992; Semlitsch and Bodie 2003; Tschaplinski 2004; Williamson, Smith, and Quinn 1992). For example, a study conducted in Tasmania found that logging within 30 meters of a class 2 stream had significant impacts on stream structure, water quality, and species composition, while logging more than 30 meters from the stream had no significant impacts. However, the authors also noted that buffers larger than 30 meters may provide greater protection during major storm events, and that variables other than width, such as vegetation types and pesticide drift, may also significantly impact stream health (Davies and Nelson 1994).

Clearcut size limits and cutting rules

Perhaps no other forest practice — including forest conversion — is as widely criticized and debated as the practice of clearcutting (referred to as "clearfelling" in Tasmania). One explanation for this is simply that clearcuts are among the most visible of human disturbances and are often considered unattractive, as well as environmentally damaging (Kimmins 1999). Another is that the advent of highly efficient, mechanized logging technology has enabled a more widespread adoption of clearcutting and the creation, in some places, of super-sized clearcuts (Rajala 1998). If one adds to this the worst cases of reckless road-building and inadequate reforestation, it is not surprising that clearcutting conjures negative images in the public mind (Williams 2005; Wood 1971).

Whatever the reasons for public dislike of clearcutting, its environmental impacts can vary greatly depending on a complex range of factors. For example, if a management goal is to regenerate native species, then managers must consider the natural conditions under which these species have evolved. In forests shaped by small-scale disturbances, natural selection would favor shade-tolerant trees. In areas prone to large-scale natural disturbances such as fire or windthrow, shade

intolerant species hold the competitive advantage. The regeneration of these shade intolerant species may therefore require larger openings. Environmental impacts are also shaped by the distribution of wood harvest across the landscape, including the impacts of the roads, landings, skid trails, and other infrastructure associated with harvest. For example, depending on frequency and intensity, a large number of small clearcuts may result in greater forest fragmentation and a longer road network than fewer and larger openings. If one also factors in economic and social considerations, then determining the "appropriate" cutting pattern becomes complicated indeed. Many of these issues were discussed for the case of Tasmanian forests in a review of forest harvesting systems requested by the Tasmanian Government in 2003 (Forestry Tasmania 2005).

If we examine forest policies for rules that address clearcutting, we can observe how different governments around the world have responded to these challenges. We therefore have selected rules governing maximum clearcut sizes as one of our policy indicators. We have also developed a standardized definition of the term "clearcut" based on the minimum cut size estimated by Kimmins to remove the "forest influence", which is "roughly equal to or greater than about four tree heights in diameter, or about 7 hectares in taller forests and 0.2 hectares in those of smaller stature (Keenan and Kimmins 1993)." Given the tremendous variability in tree heights both among and within many jurisdictions, we will further standardize our definition to openings of 1 hectare or larger.

Tropical forest management creates its own unique set of challenges. Very high levels of species diversity and a lack of markets for many of these species, reduce the economic advantages of clearcutting. Instead, environmental concerns about cutting patterns have often centered around the high-grading of desired tropical timber species, including species which regenerate poorly, if at all, after they are logged (Rice, Gullison, and Reid 1997). In order to address these issues, we use the more general indicator of "cutting rules", in addition to, or in place of, clearcut size limits, when assessing forest policies in tropical countries. A commonly used cutting rule is a minimum diameter cutting limit, which requires the protection of new tree regeneration across all species (Sist et al. 2003).

For all cutting rule policies, whether clearcut size limits or minimum diameter limits, our analysis will not include cutting restrictions within riparian buffer areas. Furthermore, in comparing threshold clearcut size limits we do not consider wildlife tree retention or harvest adjacency requirements (which commonly accompany clearcut size limits), although these issues clearly affect the environmental impacts of forest management.

In Tasmania, clearfelling in public and private natural forests is restricted to a maximum of 100 hectares "coupes" (often referred to as "cutblocks" in North America), or a maximum of 50 hectares if 50% or more of the coupe is located on slopes equal to or greater than 20°. These policies constitute mandatory, substantive requirements. Figure 13 compares these policies with those of other OECD case study countries, not including the US and Canada.

Of the case studies, NSW has enacted the most consistently restrictive policies on clearcutting within state-owned forests, reflecting both long-established silvicultural regimes in many forest types and more recent modification of regimes in *Eucalyptus delegatenis*- and *Eucalyptus seiberi*-dominated forest types (NSW 1999a). Under three of the four NSW Regional Forest Agreements, harvesting is limited to single tree selection and/or Australian group selection, with maximum openings from 0.39 to 0.79 hectares depending on the region (NSW 1999b; NSW 1999c; NSW 2002). In the Eden RFA region, "alternate coupe harvesting" using a modified shelterwood system is practiced, also resulting in an uneven aged forest (NSW 1999a). Historically, no limits were placed on clearfelling on private lands in New South Wales. This would change, however, if the Code of Practice for Private Native Forestry is adopted; the Code requires retention of at least a minimum basal area for all native forest harvesting operations (NSW 2006).

New Zealand prohibits openings greater than 0.5 hectares in beech forests and takes a procedural approach in other types of indigenous forests. This variation of policy based on forest type is classified as a "mixed" approach. A mixed approach is also employed in Japan and Sweden, involving maximum size requirements for some but not all forest types. Bavaria, Finland, and Portugal all lack clearcutting policies.

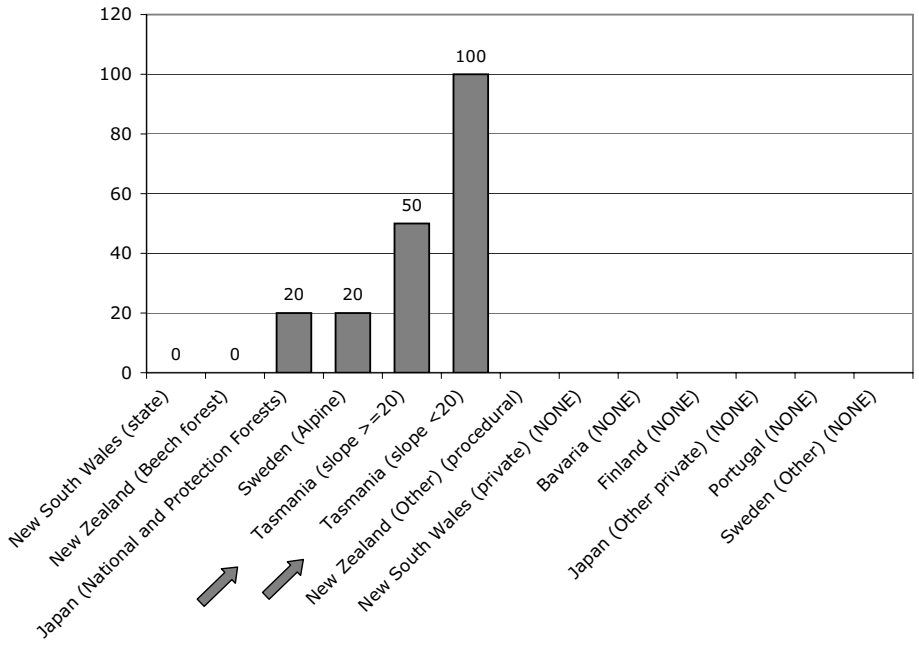

Figure 13. Clearcut size limits (ha.) of Tasmania (public and private ownerships) and OECD case study jurisdictions (excluding the US and Canada)

In comparing Tasmanian clearcutting regulations with those of Western Europe and Japan, however, it is important to consider differences in the distribution of land tenure and population density. Forested properties are relatively small in these European case study countries. For example, the average woodlot in Bavaria is 2.6 hectares (Erlbeck 1996). Hence these property sizes, in themselves, limit the size of clearcutting on any single forested property.

Many jurisdictions in the US and Canada, however, are more similar to Tasmania in their relatively low population density and larger forest tenures. Figure 14 compares Tasmanian policies with the case study US states and Canadian provinces.

The US Pacific Coast states and the Canadian provinces, like Tasmania, employ a mandatory substantive policy approach. The size limits specified fall to either side of the Tasmanian size limits. Ontario, in particular, stands out for allowing particularly large-sized clearcuts. The US Southeastern states, however, provide no rules or guidelines of any kind. FIgure 15 summarizes the regulations in Tasmania and Eastern Europe.

The clearcutting regulations of Eastern Europe, as in Tasmania, are largely mandatory and substantive. Only private forests in Poland lack prescribed clearcut size limits.

Finally, let us turn to the developing world to compare our case study policy approaches on cutting rules (Figure 16).

Chile, Indonesia, and China have all enacted manadatory substantive cutting rules. In contrast, Mexico, Madhya Pradesh, South Africa, and the DRC take a procedural approach in mandating forest plans or site-by-site prescriptions. The Brazilian approach is sufficiently unique as to be not amenable to standardized comparison. Brazil regulates harvest of natural forest by requiring that 80% of a forest property be set aside in permanent reserve. Cutting on the remainder of the property requires a "deforestation permit", which allows the conversion of forests to other land uses (Magalhães Lopes 2000). Figure 17 provides summary data on the policy approach of thirty-seven of our case study jurisdictions (excluding Brazil, for which our classification systems are not applicable).

In general, case study policies are less prescriptive than they are for riparian buffer zones. A full 39% of the case studies have no rules at all, while only 34%, including Tasmania, have enacted mandatory, substantive requirements.

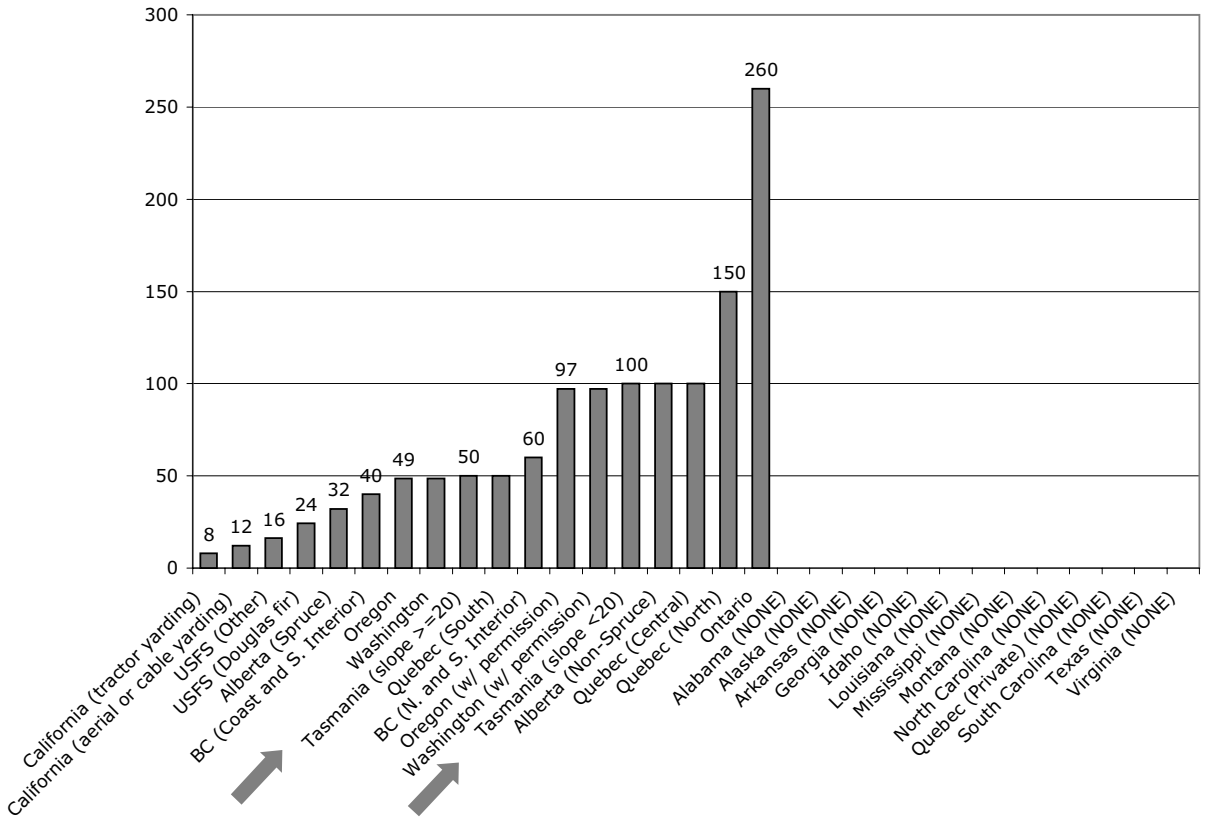

Figure 14. Clearcut size limits (ha.) of Tasmania (public and private ownerships) and the US and Canadian case study jurisdictions

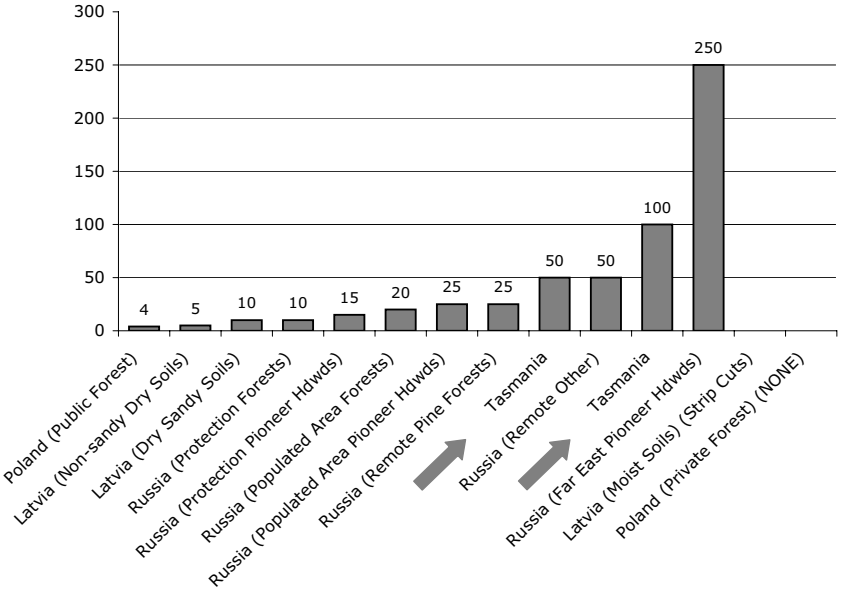

Figure 15. Clearcut size limits (ha.) of Tasmania (public and private ownerships) and Central and Eastern European case study jurisdictions

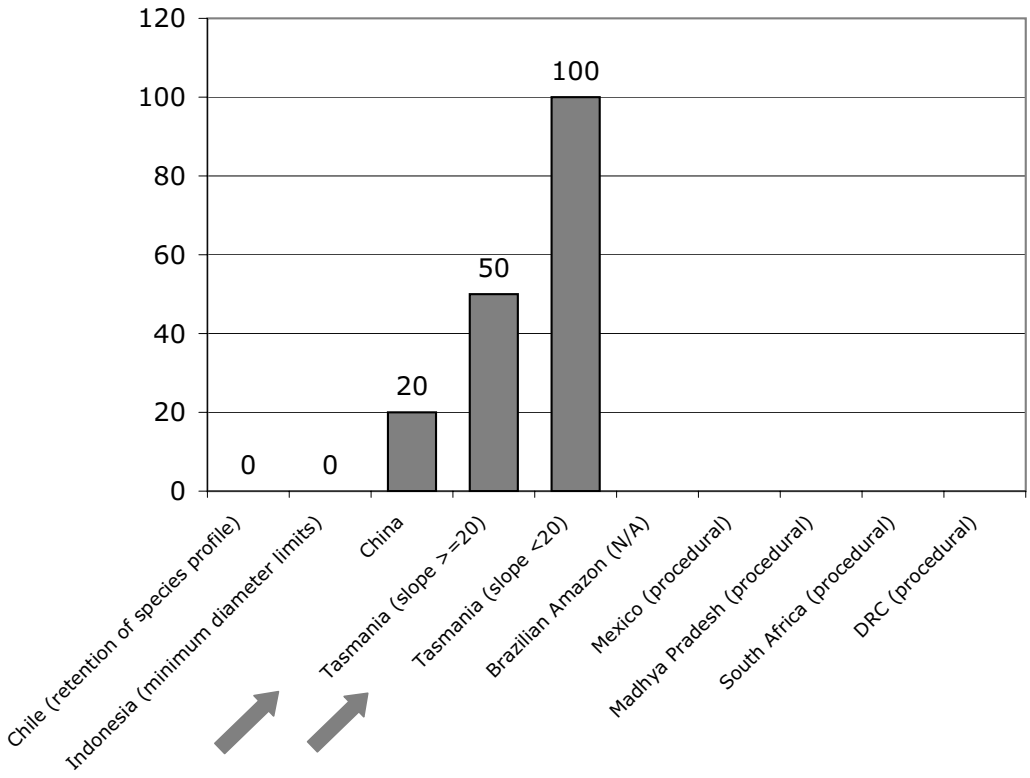

Figure 16. Clearcut size limits (ha.) of Tasmania (public and private ownerships) and Central and Eastern European case study jurisdictions

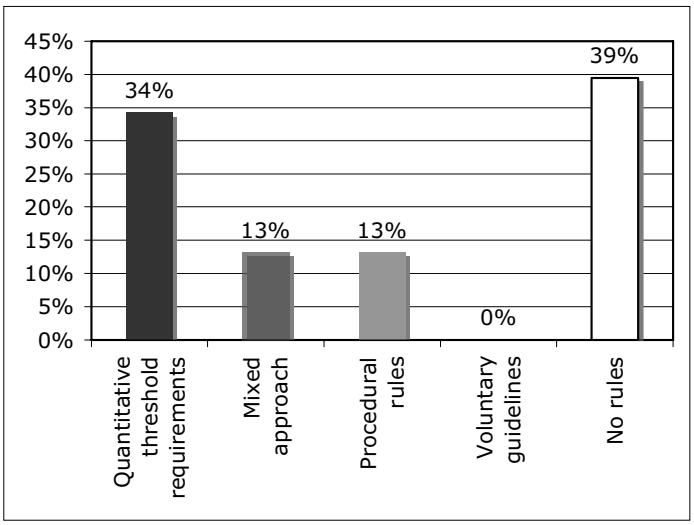

Figure 17. Policy approach of case study jurisdictions

Road streamcrossings and road decommissioning

While clearcutting may be the most widely criticized forest practice among the public at large, road-building often has much broader and longer-lasting environmental impacts (Aksenov et al. 2002). Road building is also a central point of concern for many environmental groups worldwide. Major international collaborative efforts have been focused, for example, on the conservation of "frontier forests" without roads or other high impact human disturbances (Aksenov et al. 2002; Bryant, Nielsen, and Tangley 1997).

The impacts of road building are diverse. Among the most immediate impacts are changes in soil and water quality and water flow. These changes include soil compaction, a decrease in soil permeability, alteration of stream flow and other water drainage patterns, soil erosion, and the sedimentation of streams and other water bodies.

Roads also lead to increased human traffic, with the most dramatic effects in frontier or roadless areas. In tropical countries, where poverty levels are high and enforcement measures weak, logging roads often lead to forest conversion and increasingly intensified land use. In all regions, roads may create physical barriers to the movement of wildlife, while hunting, traffic accidents, and other human-wildlife interactions may lead to the decline of some species populations.

The total impact of road building, of course, depends to a considerable degree on how it is conducted. This section, therefore, will look at two policy indicators relevant to the mitigation of a number of environmental threats. The first of these is culvert size requirements at stream crossings. Appropriate use of culverts can dramatically reduce the risk of stream sedimentation and protect fish passage. Furthermore, culvert sizes can be quantified, enabling a highly prescriptive policy approach.

The second indicator is road decommissioning, i.e. permanent road closure. A variety of road management activities, if conducted before closure, can prevent soil erosion and sedimentation as well as reduce soil compaction. Likewise, there are actions that can be taken to reduce the chances of vehicle traffic on roads that will no longer be maintained.

The Tasmanian Forest Practices Code (2000) includes mandatory, substantive requirements for culvert sizes at stream crossings. Culvert sizes are in part determined by maximum stream volumes and by road class. Within any given watershed, managers must obtain data on the average "peak" stream volume within a specified time period and design culverts adequate to accommodate that volume. Road classes are determined by their position within a road network (i.e. primary or secondary roads, spur roads and temporary tracks) and numerical estimates of log traffic (tons/week). The road classes range from Class1, the most heavily used, to Class 4, the least heavily used. A temporary track is categorized as an "access track" and is not assigned a numerical class.

Mandatory, substantive culvert sizes apply to road classes 1 to 4. On Class 1 roads, culverts must be built to withstand a one-in-fifty-year flood occurrence. For Class 2 roads, culverts must accommodate a one-in-twenty-year flood and for Class 3 and 4, a one-in-ten-year flood interval. On slopes of 20 degrees or more, major culverts must withstand a fifty-year flood interval (FPB 2000: 11). In addition, culverts must not be smaller than 372 mm. in diameter on any roads in areas of high risk for culvert blockage or failure, specifically defined as "subject to high intensity rainfall events e.g. parts of eastern Tasmania; areas with high or very high erodibility class soils; midslope roads in steep country" (FPB 2000: 10). A minimum culvert size of 300 mm in diameter is recommended in lower risk areas (FPB 2000).

In terms of road decommissioning, the Tasmanian Code 2000 states that "roads of no further use will be outsloped, water barred, or otherwise left in a condition to minimise erosion, with clean drains and blocked to vehicular traffic…" (FPB 2000: 25). While some discretion is allowed in erosion control measures, the requirement to clean drains and block traffic constitutes an inflexible requirement. Hence, in sum, the Tasmanian road decommissioning policy constitutes a mandatory, substantive policy.

Having provided an overview of Tasmania as a baseline comparison, Table 6 places this case study in the context of other approaches worldwide. Table 6 lists each jurisdiction by its policy approach to culvert sizes at stream crossings and road decommissioning for roads in natural forests. Some jurisdictions include mandatory substantive rules that are more general and less prescriptive in their requirements than those of Tasmania. Table 6 refers to these policies as "mixed". An example of a "mixed" policy for culverts would be the mandate to install culverts of "adequate" size, without standardized specifications such as minimum culvert sizes or quantified peak flow requirements. In case of road decommissioning, "mixed" refers to requirements such as "control erosion," in contrast to specific prescriptions, such as "remove all drainage structures and re-contour the road."

It is important to note that a quantitative comparison of environmental thresholds for some of the above policy indicators cannot capture important differences. An across-the-board comparison of minimum culvert sizes would overlook some extreme variability in environmental conditions between jurisdictions. Road decommissioning, as a relatively broadly defined indicator, is difficult to compare in a standardized way. There are numerous possible approaches to closing roads, from blocking vehicular traffic, to removing culverts, to re-contouring and re-vegetating the road surface.

Peak flow requirements, however, do somewhat more easily lend themselves to quantitative, cross-jurisdictional comparisons. The comparability of this indicator is due, in part, to its amenability to quantification, as well as the fact that it is, to some degree, self-adjusting to local hydrological conditions. Figure 18 provides an illustration of such a comparison, drawing on the case studies of Tasmania, the US, and Canada.

Figure 19 summarizes the policy approach of the case study jurisdictions as applied to the largest natural forest landownership type.

Of the policy criteria and indicators examined so far, the road indicators yield the fewest cases of mandatory substantive policies and the most cases where no rules or guidelines have been developed. Tasmania is among the top 14% of most prescriptive jurisdictions in regards to the combined indicators of culvert size at stream crossing and road decommissioning requirements.

Mandatory substantive rules		**Procedural rules only**	**No rules**
Culvert sizes	**Decommissioning requirements**		
Tasmania (public and private)	Tasmania (public and private)	New Zealand	New South Wales (private)
		Sweden	Portugal
New South Wales	Alberta		
Bavaria (mixed)	BC	Mexico	Alabama
Finland	Ontario (mixed)	Brazilian Amazon	Arkansas
Japan (mixed)	Quebec (mixed)	Madhya Pradesh	Georgia
			Louisiana
Alberta	California		Mississippi
BC	Idaho (mixed)		Montana
Ontario (mixed)	Oregon (mixed)		North Carolina
Quebec (public)	USFS (mixed)		South Carolina
	Washington		Texas
Alaska			Virginia
California	Bavaria (mixed)		
Idaho	New South Wales (mixed)		Quebec (private)
Oregon			
USFS			Poland
Washington	Indonesia (procedural)		
			Chile
Latvia (surfaced roads only) (mixed)			South Africa
Russia			
Indonesia			

Table 6. Policy approach of case study jurisdictions

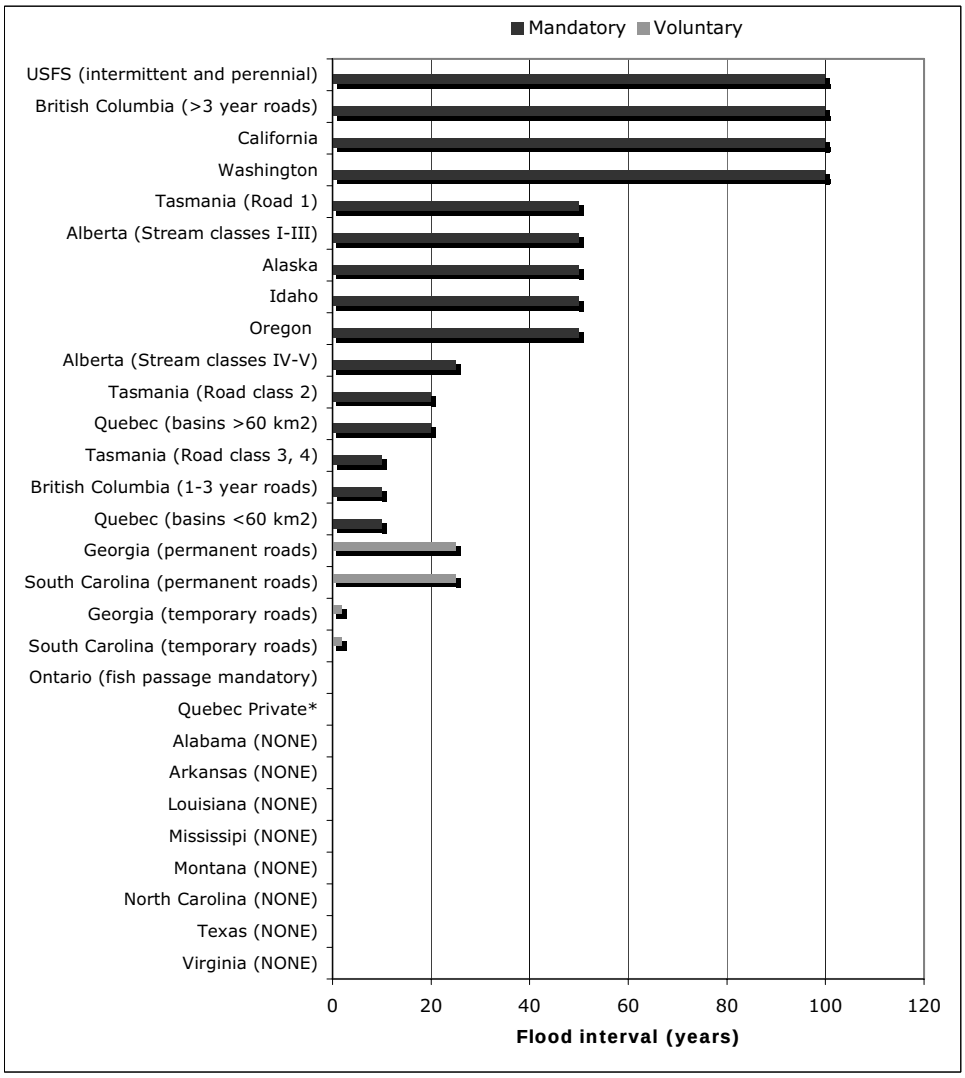

Figure 18. Peak flow, flood interval specifications for culvert design in Tasmania (public and private ownerships) and US and Canadian case study jurisdictions

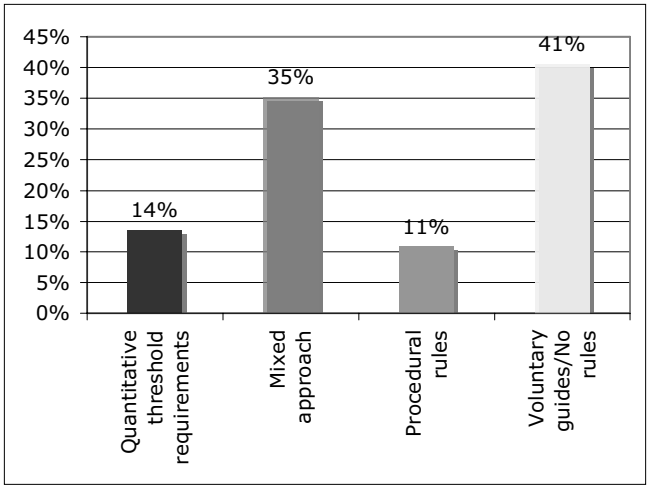

Figure 19. Combined policy approach of case study jurisdictions (%) to two road indicators (culvert sizes and decommissioning)

Reforestation

The regeneration of forests after a harvest is clearly an integral part of sustainable forest management. We examine policy prescriptiveness in terms of 1) the presence of quantitative thresholds for prescribed stocking levels, and 2) time frames for achieving those levels. In cases where harvest involves the removal of the majority of a forest overstory, stocking levels are commonly expressed as a number of seedlings per hectare. In the case of selection cuts, however, other measurable objectives may be prescribed.

The Tasmanian FPC mandates stocking standards for clearfelling, shelterwood, even-aged regrowth, and multi-aged stands. Furthermore, the Code states that required Forest Practices Plans "will specify the establishment and maintenance of treatments that are most likely to achieve full restocking (FPB 2000:85,86)." The 1991 Native Forest Silviculture Technical Bulletin 6, since updated in 2003, prescribes stocking standards levels and time frames by forest type (Forestry Commission Tasmania 1991; Forestry Tasmania 2003).

Table 7 summarizes the reforestation policies of Tasmania together with the other case study jurisdictions. Nineteen of the case study and land ownership types listed in Table 7 prescribe both stocking levels and time frames, while three employ a mixed approach. The mixed approaches, however, vary in their scope and specificity. Tasmanian public and private forestlands and New South Wales public

Mandatory Reforestation Standards or Policies	Procedural	Voluntary Reforestation Standards or Policies	No Reforestation Standards or Policies
Tasmania (public and private)* ⇑	Louisiana	Portugal	New South Wales (private)
New South Wales (public)* ⇑	Mexico Madhya Pradesh South Africa	Arkansas Georgia Montana South Carolina	Quebec (private)
Finland * ⇑			Alabama Mississippi North Carolina Texas Virginia
Bavaria * ⇑			
New Zealand * ⇑			
Japan * (mixed)			
Sweden * ⇑ (mixed)			
Alberta * ⇑			Brazilian Amazon (deforestation permits)^
British Columbia * ⇑			
Ontario * ⇑			
Quebec * ⇑			
Alaska * ⇑			
California * ⇑			
Idaho * ⇑			
Oregon * ⇑			
Washington * ⇑			
USFS * ⇑			
Poland * ⇑			
Latvia * ⇑			
Russia * ⇑			
Chile ⇑ (mixed)			
Indonesia (mixed)			
DRC * ⇑			
Timeframes *			
Stocking prescriptions ⇑			

Table 7. Reforestation policies of case study jurisdictions

^In the Brazilian Amazon, 80% of private properties must be maintained as forest reserve.

lands must meet specific stocking levels. NSW, like Tasmania, requires site assessments to determine if such stocking levels have been reached. Chile prescribes stocking levels but with no specifications for surveying or meeting those levels. Japan, in contrast, specifies time frames but not stocking levels. Indonesia requires reforestation without any specific prescriptions.

Keeping in mind the different range of policies encapsulated by the term "mixed," Figure 20 illustrates the distribution of policy approach across case studies as they apply to the "majority natural forest ownership" type.

Thirty-nine percent of the case study jurisdictions, including Tasmania, specify stocking levels and time frames, while 16% employ mixed approaches where the stocking levels and/or the time limits are determined on a case-by-case basis. In 29% of the cases, forest managers are under no obligation to reforest.

Annual allowable cut

Annual allowable cut (AAC), i.e. the establishment of limits to the volume of timber that may (or must) be harvested within a year, is a policy setting that can have profound influence on the environmental impacts of forest management. AAC may be designed to meet a variety of other objectives in addition to, in conflict with, or in place of environmental concerns. In particular, the stated goals of AAC on public lands may focus primarily on socio-economic concerns, such as economic development and community stability, and hence, such AAC requirements may not constitute an "environmental" policy. The criterion we have used in this report to determine the "stringency" of AAC policy, is therefore based on not only the existence of AAC requirements, but also on the establishment of sustained yield as a threshold limiting maximum allowable cut volumes.

We have identified those policies that base limits on AAC on the non-declining even flow principle of sustained yield as the most prescriptive. The even flow policy is classified as the most non-discretionary, because it represents a relatively standardized restriction on annual harvest limits. In contrast, a

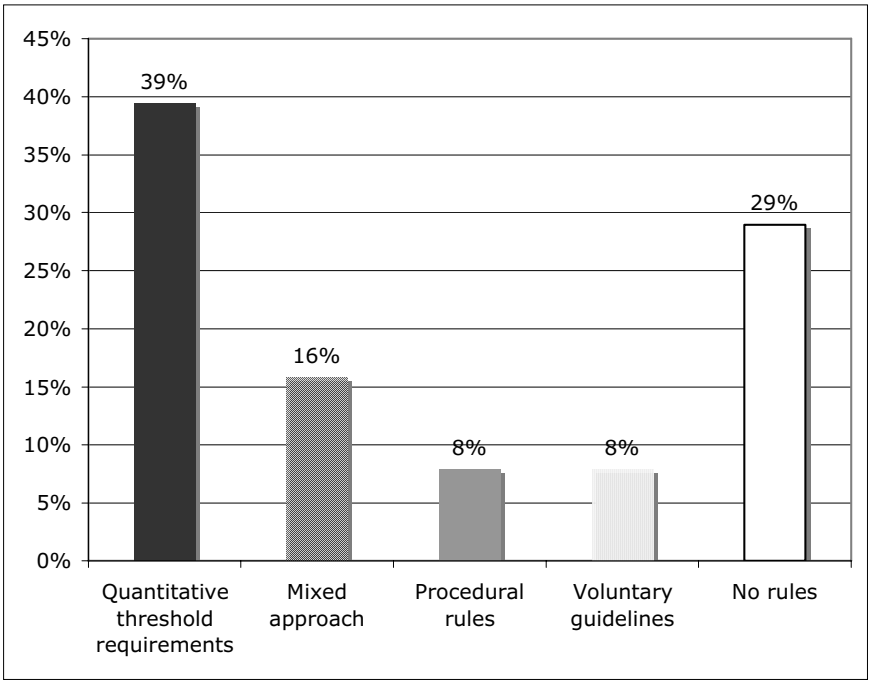

Figure 20. Combined policy approach of case study jurisdictions (%) to two reforestation indicators (stocking levels and time frames)

"mixed" substantive rating was assigned to those policies that impose caps on AAC on the basis of calculations of sustained yield, but do not restrict AAC volumes based on an even flow policy. The latter policy approach is considered "mixed" due to the highly variable mix of environmental, social, and economic considerations that may be involved in determining the sustainability of different cut levels. The "procedural" category was assigned to AAC policies that require the establishment of AAC targets but do not expressly require that AAC volumes be based on sustained yield.

Tasmanian policy on AAC is based on the 1920 Forestry Act and the 1997 Tasmanian Regional Forest Agreement (RFA). The Forestry Act requires a yearly *minimum harvest* of 300,000 cubic meters of eucalypt veneer logs from state lands (Section 22 AA). Pulpwood yields are then derived from these sawlog commitments. The resulting state level AAC includes both natural forests and plantations. The RFA provides further direction in accrediting Forestry Tasmania's methodology for determining sustained yield (Clause 66) and requiring that these methods be made public (Attachment 11.2). The required harvest has been raised to 350,000 cubic meters per year for the ten years between 2001 and 2011, to "make suitable land available to enable plantation establishment as part of the Forestry Growth Plan" (Forestry Tasmania 2002: 14).

Tasmanian state policy is best classified as a "mixed" policy in that it addresses only high quality eucalypt sawlogs, rather than all wood production, and mandates a "non-declining" harvest rather than capping production at "even flow." Private landowners are not bound by state-mandated annual cut levels. Table 8 places the Tasmanian approach to AAC in the context of the other case study jurisdictions. This yields the following distribution of policy approaches as they pertain to the largest natural forest ownership type in each case study jurisdiction (Figure 21).

The Tasmanian approach to AAC on public lands (the majority ownership type) is "mixed," placing it among the top third most prescriptive of policies. Only (8%) of AAC policies take a more prescriptive approach, constraining cut levels to amounts that can be consistently maintained over both the short and long term. In the cases of a mixed policy approach, the phrase "sustained" yield may accommodate cut levels aimed at increasing timber production by accelerating the harvest of older and/or less productive trees and replacing them with younger, faster growing trees. Twenty-one percent of the case studies take a procedural approach by requiring AAC calculations without expressly capping those requirements at sustained yield levels. Finally, a full 40% of the jurisdictions covered do not include any mandatory restrictions on cut levels. If we examine this pattern in light of the preceding table, a lack of AAC policy would appear typical for private lands worldwide. The largely communal properties of Mexico and private lands in California constitute notable exceptions.

Prescriptive (AAC capped by an even flow policy)	Mixed (AAC capped by sustained yield, but not even flow)	Procedural (AAC required but not capped by sustained yield)	Voluntary (No mandatory requirements for AAC determination)
USFS	Tasmania (public)	BC	Tasmania (private)
Russia	New South Wales (public)	Ontario	New South Wales (private)
Mexico	New Zealand	Bavaria	Finland
	Alberta	Latvia (public)	Japan
	Quebec (public)	Chile	Portugal
	California	China	Sweden
	Poland	Madhya Pradesh	Quebec (private)
	DRC	South Africa	Alabama
	Indonesia		Alaska
			Arkansas
			Georgia
			Idaho
			Louisiana
			Montana
			Mississippi
			North Carolina
			Oregon
			South Carolina
			Texas
			Virginia
			Washington
			Latvia (private)
			Brazilian Amazon

Table 8. Policy approaches to AAC calculations

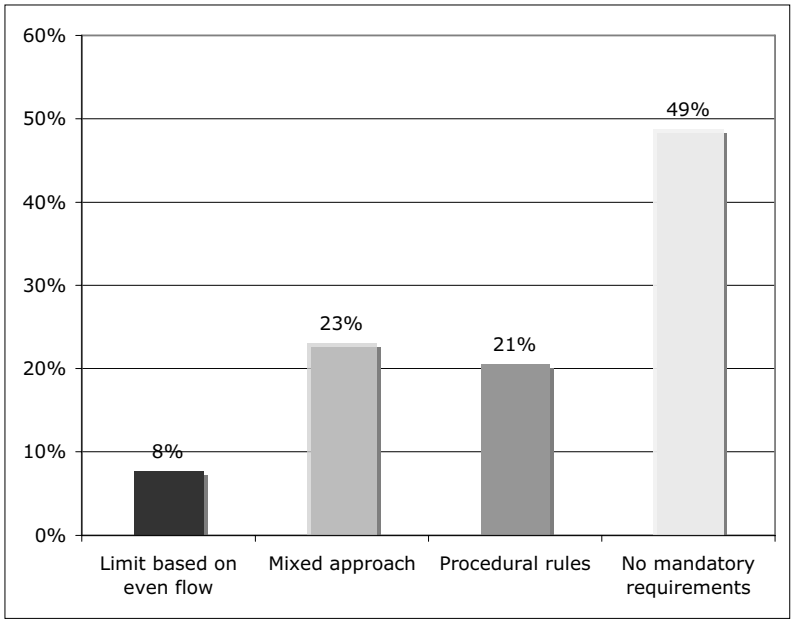

Figure 21. Policy approach of case study jurisdictions (%) to annual allowable cut (AAC) calculations

Plantation Policies

The importance of plantations[13] as a global source of fiber has grown dramatically in recent years. The catalysts for this growth are numerous and include a decrease in available forest resources due to depletion of natural forests, increased efforts to conserve the remaining natural forests, improved plantation technologies, and global competition for cost-effective production. In addition, government policies have arguably been "at least as important as economics in determining forest plantation patterns (Brown 2000)." Governments have participated either directly in plantation development on public lands, or provided subsidies, tax breaks, or other kinds of economic incentives for plantation development on private lands. Motives for government support range from improving forest industry competitiveness, to supporting rural economies through non-industrial plantation development.

For this wide diversity of reasons and more, the global area covered by forest plantations has been increasing. The global plantation estate almost doubled between 1980 and 1995, and growth has accelerated since that time. In 2000, plantations accounted for only about 5% of the world's total forest area and were responsible for an estimated 35% of total roundwood production. While estimates for future plantation growth vary considerably, a moderate growth model projects that plantations will produce 44% of global roundwood by 2020 (FAO 2001).

The diversity of reasons for plantation growth is echoed by major variation between regions and between countries. From a production perspective, plantations have been particularly dominant in Oceania, accounting for 55-85% of production, and in South America, accounting for 32-63% of production (Brown 2001).[14] In terms of overall area under plantation, however, Asia contains the largest expanse of plantations. Within all regions, plantation coverage varies dramatically between countries. China, Russia, the US, India, and Japan account for roughly two-thirds of the world's total plantation resource (Brown 2000).

While plantations have clearly been growing in size and economic importance, their impacts on natural forest management remain highly uncertain. A major argument in support of plantations has been that they take pressure off of natural forests by concentrating wood production in relatively small areas. Others claim that government subsidies and incentives for plantation development have contributed to depressed valuation of natural forests, which in turn creates disincentives to maintain land in natural forest or otherwise invest in sustainable forestry (Bull et al. 2004). Whatever the net environmental impacts of plantations and the policies governing their development, plantations have indisputably exerted some direct pressure on natural forests. Specifically, almost half of the plantations created in the 1990s were established through the conversion of natural forests (Brown 2001).

While acknowledging these broader questions of sustainability, our primary focus is on the comparison of plantation extent and environmental policies governing plantation management in our case study jurisdictions. Figure 22 provides a global comparison of plantation areas.

At the time these data were collected, plantations represented less than 1% of Australia's forestlands in the year 2000, placing Australia in the bottom third of our case study countries. In terms of total plantation area, Australia ranked eleventh out of seventeen cases.

In India, China, and Japan, the three countries with the largest percentage of forests in plantation, a major portion of plantations are established for non-industrial uses, including household subsistence and/or environmental protection (CCICED 2002; FAO 2005; GOI 1988; Kant 2001; Yamane 2001). In contrast, industrial production is a major focus for Russia, the US, Indonesia, Brazil, South Africa, and New Zealand (FAO 2005), all of which report more plantation area than Australia.

[13] This report adopts the 2001 FAO definition of "plantations". The FAO defines plantations as "forest stands established by planting and/or seeding in the process fo afforestation or reforestation. They are either of introduced species (all planted stands), or intensively managed stands fo indigenous species, which meet all the following criteria: one or two species at planting, even age class, regular spacing" (FAO 2001).

[14] The variable figures reflect two different sources both included in the 2001 FAO report.

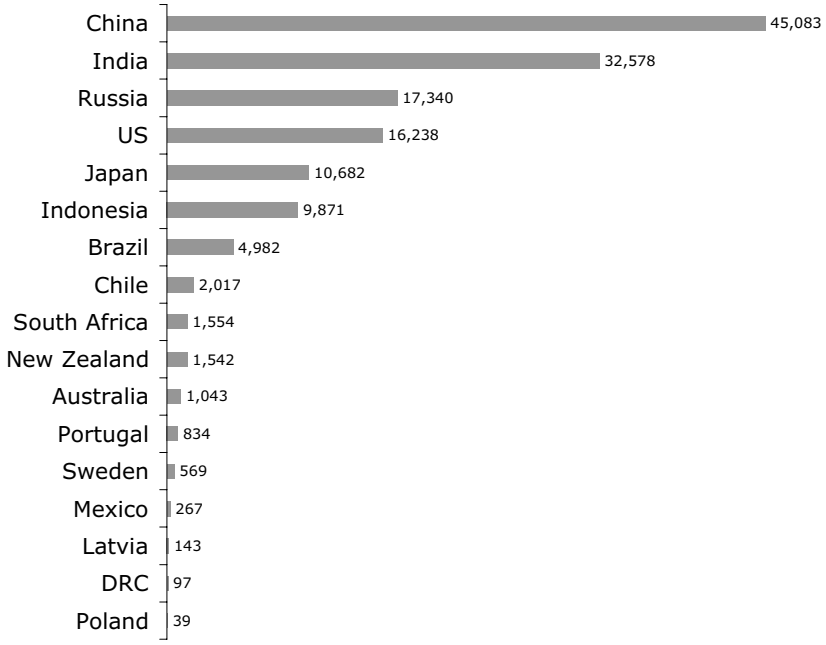

Figure 22. Forest plantations^ ('000 ha) in 2000. Source: (FAO 2003)

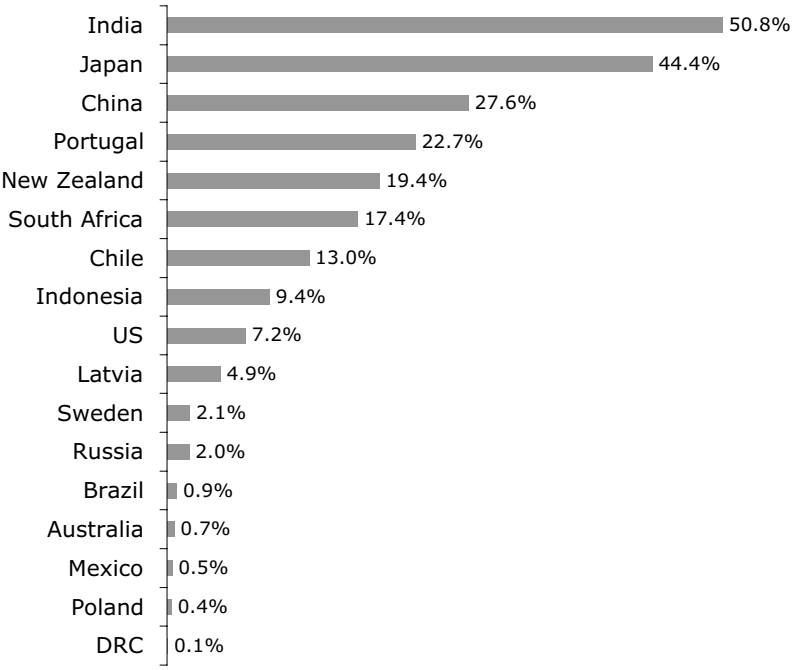

Figure 23. Percent of forest area in plantations^ in 2000*. Source: (FAO 2003)

^ In 2001 plantations were defined by the FAO as "forest stands established by planting and/or seeding in the process of afforestation or reforestation. They are either of introduced species (all planted stands), or intensively managed stands of indigenous species, which meet all the following criteria: one or two species at planting, even age class, regular spacing" (FAO 2001).

* Germany, Finland, and Canada are excluded from this chart, due to a lack of figures in the FAO database for plantation area in these countries.

If we consider the relative contribution of plantations to production rather than forest area, however, plantation wood accounts for an increasingly large percentage of Australia's total industrial roundwood production. Government policy has supported this growing plantation industry. In 1997, the Australian Government partnered with industry interests in a pledge to triple the country's plantation area by the year 2020. The principle behind this vision was to "enhance regional wealth creation and international competitiveness through a sustainable increase in Australia's plantation resources…" (Plantations 2020 2002).

The Tasmanian forestry industry has been active in the development and promotion of the plantation vision (Plantations 2020 2006), and Tasmanian policy has supported plantation growth at the state level. A commitment to plantation development was voiced in the 1997 Tasmanian Regional Forests Agreement (RFA) and articulated in the Tasmanian Community Forest Agreement (TCFA). The TCFA calls for an increase in natural forest protected areas in exchange for growth in plantation production (Australia, and Tasmania 2005c).[15]

Tasmania's environmental policies governing plantation management are articulated in the Forest Practices Code (FPB 2000) and are similar to those applying to natural forests. Riparian buffer zone sizes are the same (with modified management requirements within special management zones), clearfelling size limits are the same for slopes 20º or greater, reforestation standards are equally prescriptive, and road management standards are the same in all productive forests. The 100 hectares clearfelling size limit on slopes less than 20º, however, does not apply to plantations. AAC targets apply to the total production from state-owned forests, natural and plantation, but do not apply to private forestlands.

Similarly to Tasmania, New South Wales has set targets for the expansion of both eucalypt and softwood plantations; however, in NSW, plantation development is exclusively focused on cleared agricultural land (SFNSW 1997). Unlike Tasmania, different Codes have been developed for state-owned natural forests and plantations. From 1997 to 2004, the forest practice guidelines for state-owned plantations were covered in a Code for "Plantation Establishment and Maintenance" (SFNSW 1997). Guidelines included riparian buffer zone standards, prohibiting the clearance of native trees within 100 meters of water storages, 20 meters of prescribed streams, and inside a 5-meter special management zone along drainage lines and drainage depressions (SFNSW 1997). In addition, road management has been subject to state standards. These standards have since been replaced by a more detailed Plantation Code (NSWDPI 2005). The Plantation and Reafforestation (Code) Regulation 2001 applies to both state and private lands and outlines mandatory streamside buffers and road-building guidelines (MLWC 2001).

In New Zealand, a massive privatization effort beginning in 1984 led to the transfer of almost all state owned plantations to private ownership. The New Zealand Forest Accord, signed in 2001 by a diverse range of stakeholders, served to validate and highlight the growing policy divide between a strongly conservation-oriented approach to indigenous forest management and a production-oriented approach to plantations. Wood harvest in indigenous forests is very limited and heavily regulated, while plantation management is covered by voluntary forest codes and principles. These voluntary guidelines include the Principle for Commercial Plantation Management in New Zealand (1995); Verifying Environmental Performance: Draft Report Card, User Guide and Audit Protocol (1999); and the New Zealand Forest Practice Code, (latest edition 1993), which provides non-binding technical guidelines for forest management of non-indigenous forests.

Finland and Germany have very little land in plantation forest. The planting of exotic trees in Finland requires special permission. In Sweden, there are no limitations on planting exotics and no distinction between rules governing natural forests and plantations. Portugal takes a voluntary approach to the management of both natural forests and plantations, with little distinction between the two.

[15] As part of the effort to fulfill this agreement adn meet state-mandated annual cut levels, up to 5% of the 1996 native forest area may be converted to plantations. This report's section on biodiversity includes a discussion placing this conversion policy in a global comparative context.

The Canadian provinces contain very limited forest plantation area and, generally, do not provide separate rules for plantations established on forestlands. The US South, in contrast, contains extensive plantations, accounting for 35% of all softwood removals in 1999 (Wear and Greis 2002). Across the US, many top wood-producing states have supported plantation growth through tax breaks or other economic incentives. In terms of environmental plantation policies, our Southeastern case study states apply the same voluntary forest practice guidelines to plantations as they do to natural forests. On private lands in Washington and Oregon, short rotation plantation management qualifies as agricultural practice and hence, falls under agricultural rather than forestry regulation (Copestake 2003).

In Central and Eastern Europe, natural forests are not distinguished from plantations in forest policy. Poland, however, has enacted a general rule prohibiting the planting of exotic species on forestlands. In terms of state sponsorship of plantation growth, the Russian Government has been active in the development of the country's vast plantation resource (Russian Federation 1993).

Among our developing country case studies, India, China, Indonesia, Brazil, Chile, and South Africa all exceed Australia in plantation area. Plantation development in all of these countries has received strong state support.

In India and China, the national government has set ambitious targets for afforestation and the rehabilitation of degraded forestlands. Non-industrial forest use and conservation are a major focus of plantation development in these countries.

Most of the plantation area in Brazil is located Southern Brazilian states, outside of our Amazonian case study region. At the national level, the Brazilian Forestry Code requires that rural properties everywhere retain a minimum of 20% of the property in permanent forest reserve. Riparian zones are also protected and harvesting permits are required in all types of forests, including plantations. In addition, some Brazilian states have enacted their own forestry legislation, including specific provisions for plantation management. Chile, in contrast, imposes few management restrictions on plantation forests.

Indonesian forest policy lists grasslands and unproductive forest areas as priority areas for plantation establishment. In practice, however, the conversion of natural forest to plantation is a common occurrence (Barber, et al. 2002; Dauvergne 2001). Exotic species are established primarily for pulp and paper production, while native species supply wood for furniture and construction. The Indonesian Government allows the conversion of natural forest to plantations of both forestry and estate crop species, and this conversion has been happening at the scale of millions of hectares per year (Barber et al. 2002).

South Africa produces the vast majority of its wood in plantations. No new plantation development has been allowed over the last few years, and thousands of hectares of plantation have been withdrawn from the plantation landbase due to water shortage concerns. The primary pieces of legislation governing plantation management in South Africa include the National Forests Act of 1998, the 1996 National Forest Strategy, and the 2001 Amendment to the 1983 Conservation of Agricultural Resources Act (which specifies riparian zone requirements). A number of voluntary best management practice guidelines have also been established, such as the South African Harvesting Code of Practice, produced by the Forest Engineering Working Group of South Africa (FESA); the South Africa Criteria and Indicators for Sustainable Forest Management; and the "Environmental Guidelines for Plantation Forestry in South Africa".

In sum, our case study countries vary tremendously in the extent of plantation development, the purpose of the plantations, and the environmental policies that apply to plantations. Despite this diversity, the practice of providing incentives and/or subsidies to encourage plantation growth is commonplace. In terms of policy approach, case study countries with more restrictive natural forest policies also include more mandatory requirements for plantations. For example, Tasmania applies the same level of prescriptiveness to plantation and natural forest policies for four out of the five forest practice indicators included in this report. Where there is a difference between natural forest and plantation policy in our case study states, however, the rules for plantations tend to be less restrictive.

The most fully developed policies focused specifically on industrial plantation management are found in Tasmania, New South Wales, New Zealand, and South Africa. This could be explained, in part, by the relatively large percentage of industrial timber production coming from plantations in these jurisdictions. However other jurisdictions with large-scale industrial plantation production, such as the southeastern states of the US, lack plantation-specific forest practice policy guidance.

Biodiversity Protection Policies

The conservation of biodiversity ranks among the top priorities of numerous global-scale environmental agencies, conventions, and other multinational governance tools. The achievement of this environmental goal, however, presents an enormously complex policy challenge. At a most basic level, all forest practice policies have potential impacts on biodiversity. For the purposes of this report, however, we focus on two key policy indicators, aimed directly and expressly at the conservation of species and their habitats. These are 1) legislation to protect species at risk, and 2) the establishment of protected areas excluded from commercial timber harvest.

Protection of species at risk

Policies specifically aimed at the protection of species at risk may consist of any or all of the following key components: 1) the required identification of species under threat, which may include vertebrates, invertebrates, plants and/or other life forms, 2) restrictions or prohibitions on the harvest of those species, and 3) habitat protection.

Both the Australian and Tasmanian governments have enacted several pieces of legislation that address all of these components to varying degrees. Major pieces of relevant legislation at the national level include the National Parks and Wildlife Act of 1970, the Endangered Species Protection Act of 1992, the Commonwealth Environment Protection, and the Biodiversity Conservation Act of 1999. At the state level, Tasmania has enacted its own Threatened Species Protection Act (1995) and has further addressed species at risk in the Tasmanian RFA.

Under this suite of policies, species at risk - including vertebrates, invertebrates, and vascular plants, as well as mosses and lichens - are to be identified and protected. In addition, habitat restoration and the linkage of habitat strips are prioritized in areas containing species of high conservation significance. The Tasmanian RFA also calls for the development of agreed management prescriptions for species protection involving consultations among landowners; the Forest Practice Officers from the Forest Practice Authority; and specialists from the Tasmanian Department of Primary Industries, Water, and Environment (Australia and Tasmania 1997).

Outside of Tasmania, acts specifically aimed at the protection of endangered species are found in Canada (at the Federal level as well as in Ontario and Quebec), the US (including primarily the US Endangered Species Act, but also a number of state-level acts both in the western and southeastern US states), Portugal, NSW, Japan, Russia, Latvia, Mexico, and Indonesia. The systems for listing species at risk, the range of plants and/or animals covered by endangered species legislation, and the degree of protection that species identified as threatened are afforded, varies greatly between these case studies. Furthermore, some jurisdictions without endangered species acts per se have established protection requirements that are more stringent than many of the acts themselves. Nevertheless, Tasmanian legislation is among the most prescriptive in its coverage of both species and habitat protection and the creation of well-defined regional planning and public consultation procedures for implementing these policy commitments.

Protected areas

A comparison of protected areas on a global scale is rendered more challenging by the lack of reliable and comparable information. There are numerous categories of protected areas that may or may not be included in government estimates, ranging from roadless wilderness areas, to heavily commercialized nature parks, to indigenous peoples' reserves, to private conservation easements, to riparian reserves and other special management zones. To date, the United Nations Environment Program World Conservation Monitoring Center (UNEP WCMC) provides the most comprehensive, global-scale database on the extent of protected areas. The provision of data on protected areas, however, is voluntary and non-standardized, limiting its consistency, timeliness, and accuracy. Furthermore, data analysis is not provided at the level of sub-national jurisdictions.

The following chart summarizes the World Database on Protected Areas (WDPA) 2006 figures for our twenty case study countries, as well as Tasmanian records of protected areas within the state by IUCN category (WDPA Consortium 2006). The WDPA uses the World Conservation Union (IUCN) classification system to categorize protected areas by conservation

Class from I to VI, with Class I denoting the most strictly protected areas and Class VI containing the fewest management restrictions. For the purposes of this report, our analysis is restricted to IUCN Classes Ia, Ib, and II, which denote strict nature preserves, wilderness areas, and national parks, respectively.

As of 2006, the State of Tasmania reported a larger percentage of land area protected by parks and wilderness areas than that found among the national-level case studies. At the countrywide level, Australia had the fifth highest percentage of its land area protected under IUCN Categories I & II, with Sweden the highest. OECD, Central and Eastern European, and developing countries in general are fairly well spread across the spectrum. The lack of consistency in country reporting, however, precludes firm conclusions about the land area officially protected, while varying capacities of enforcement make global-scale comparison even more problematic.

The Australian government, however, has adopted the use of IUCN protected area categories contributing to the country's relatively precise representation within the WDPA database. Furthermore, data is available on the distribution of Australia's protected areas across different ecosystem types. One of the principal tenets of Australia's Regional Forest Agreement process was the establishment of a "comprehensive, adequate, and representative" (CAR) reserve system, with quantitative targets for the conservation of forested ecosystems, in all RFA regions (DAFF 2003b). As mentioned earlier, the further expansion of protected areas was a major component of the 1997 RFA, which added an additional 473,474 hectares of formal public reserve areas (RPDC 2002). In 2005 the TCFA added an additional 148,000 hectares of public land reserves (Australia and Tasmania 2005b). Between 1997 and 2006, the protected area system has been expanded by over 540,000 hectares (DPIW and Forestry Tasmania unpublished). Most of this additional area falls under IUCN categories III-VI, defined internationally as national monuments, habitat/species management areas, protected landscape/seascapes, and managed resource protected areas, respectively. In Tasmania, no harvesting is allowed in any of these reserve categories.

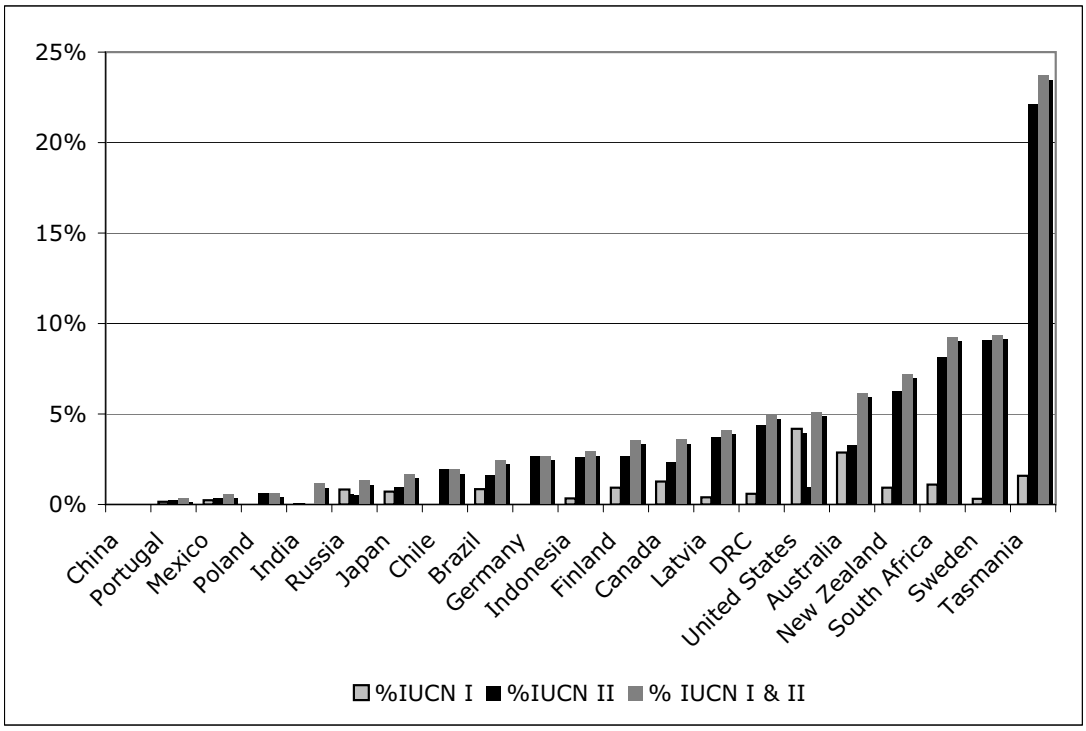

Figure 24. IUCN Protected area categories I and II as percentage of total land area in 2006. Source: WDPA Consortium 2006; Tasmanian data provided by Biodiversity Conservation Branch of the Department of Primary Industries and Water, Tasmania and Forestry Tasmania, August 2006.

The creation of protected areas, of course, does not occur in isolation from other policy considerations. For one thing, the extent to which a protected area system conserves key species and habitats depends on where those reserves are located. For another, the creation of reserve areas may impact forest practices elsewhere.

In Tasmania, the expanded protected areas system outlined in the RFA reduces the harvest volumes available from natural forests and hence, the state's capacity to reach its legislated AAC requirements. The RFA has addressed this problem by encouraging intensification of natural forest management and allowing some conversion of natural forest to plantation. The conversion of natural forests to plantation reduces local populations of species dependent on native forests. The extent of this habitat loss is limited by the "Permanent Forest Estate Policy … which aims to maintain an extensive and permanent native forest estate on both private and public land in Tasmania. The policy sets statewide, bioregional, and forest community minimum threshold percentages below which native forest vegetation cannot be cleared for conversion to other uses" (FPA 2005). This Policy[16], promulgated in 1997 as part of the Tasmanian RFA and revised in 2005 in conjunction with the TCFA, requires that at least 95% of the 1996 statewide extent of natural forest be retained as natural forest, limits the extent of conversion in any particular forest community, and commits to the phasing out of natural forest conversion – on public land by 2010 and on private land by 2015[17] (DPIW 2005).

If we place Tasmania's policy towards conversion in the context of other OECD jurisdictions, we find conversion is often prohibited on public lands but allowed on private forestlands. Trends towards increasing privatization in some countries, therefore, could result in forests currently under public ownership becoming available for conversion by private owners. However, zoning laws, conservation easements, and other forms of area-based protection can and sometimes have placed additional limits on private land conversion in developed countries.

In lesser-developed countries, conflicting concerns about economic development and environmental protection coupled with insecure land tenure often lead to conflicting policies on forest conversion. In Mexico, for example, while forest laws emphasize conservation, forest clearance has long been used as a means to strengthen land claims. Forest conversion has been allowed in Chile, with several restrictions (e.g., that an area of natural forest within the same watershed equivalent in size to the converted forest area be set aside for conservation), and must be approved by the Corporación Nacional Forestal (CONAF). The Brazilian Amazon allows forest conversion across 20% of a given private property while requiring that 80% of the remaining forest is held in reserve. The Tasmanian policy also imposes limitations on the extent of forest which can be converted - but on a state, forest community, and bioregional basis, rather than on an individual property basis, while allowing conversion of natural forest to plantation forest and other uses within these limits for the purposes of economic development - as does, for example, Indonesia. Written policies aside, deforestation rates in Mexico, Brazil, and Indonesia are among the highest in the world.

In sum, the comparison of area-based conservation strategies yields a complexity of contextual issues. Hence the study of policy *impacts* would require a focus that extends beyond individual protected areas to consider the issue of forest conversion and other potential policy interactions.

[16] As of November 2005, the policy has been renamed the "Permanent Native Forest Estate Policy" Tasmania. 2005. Tasmanian government policy for maintaining a permanent native forest estate: State of Tasmania.

[17] The policy requires that threatened forest communities are maintained (with limited exceptions) and that non-threatened forest communities are maintained at a level no less than 50% of 1996 cover in each IBRA (Interim Bioregionalisation of Australia) bioregion. The policy requires a review of the conservation status of non-threatened forest communities if their cover falls below 75% fo 1996 cover, or below 2000 hectares (whichever is earlier). In practice, there have been differential impacts on different forest communities; the extent of conversion of particular communities is reported in the FPA Annual Report (eg., for 2005-6: http://www.fpa.tas.gov.au/fileadmin/user_upload/PDFs/General/FPA_annual_report_0506_web_2.pdf.)

Enforcement and Compliance Policies

Clearly, the *effectiveness* of environmental forest policies depends in part on the ability to achieve policy compliance. By definition, mandatory policies enable governance systems to enforce compliance and discipline rule-breakers. Voluntary policies, in contrast, are created to educate forest managers and/or create incentives for improved forest practices. There is considerable debate as to when and where mandatory or voluntary rules are most effective in achieving compliance (Ellefson 1995; Hatch 2005; Kilgore and Blinn 2004). This study is not intended to resolve that debate but rather provides an initial analysis comparing and contrasting the ways in which different jurisdictions have structured forest policy enforcement. This paves the way for future research on the combined effect of forest policies and compliance mechanisms in achieving desired management practices.

In Tasmania, the Forest Practices Authority (FPA) (formerly the Forest Practices Board) is in charge of enforcing forest practice laws on both public and private lands. "Forest practices" on all land ownerships require Forest Practice Plans certified by qualified Forest Practice Officers (FPOs). "Forest practices" include a wide range of activities from forest clearance, to timber harvest, to, in some cases, firewood collection. On private lands that are not designated as Private Timber Reserves, forest practices require additional approval from local government authorities.

The FPA is responsible for certifying FPOs and for auditing landowner compliance with the Forest Practices Code and Forest Practices Plans. FPOs (generally employees of the larger landowners, or consultants employed by smaller landowners) are required to prepare and certify Forest Practices Plans, conduct audits of each forest operation conducted under a Plan, and lodge compliance certificates on the completion of discrete operational phases described in the Plan. In addition, the FPA conducts random audits on about 15% of forest practices plans annually, using its own FPO-qualified staff and FPO-qualified consultant auditors. Furthermore, the FPA also investigates reported rule violations. In cases where violations are verified, the maximum penalty for each violation has recently been increased from A$15,000 to A$100,000. The FPA produces an annual report that outlines the results of FPA audits (FPA 2006).

In contrast to Tasmania, many jurisdictions have enacted very different environmental forest practice policies on private versus government land. The difference in policy approach in itself influences the methods used for monitoring, enforcement, and reporting. For example, on private lands in New Zealand to date, there has been a lack of forest practice policies or state-endorsed best management practices that apply to natural forest management. This lack of policies precludes any monitoring and/or enforcement of policy compliance.

At the opposite end of the spectrum, the US Forest Service is governed by some of the most restrictive policies addressed in this report. The content of the policies themselves, combined with the nature of the US judicial system and high levels of public controversy, have resulted in a litigious approach to policy enforcement. The most notable example is the roughly 75% reduction of timber production over the course of a few years in response to a court ruling on the Endangered Species Act (Cashore and Howlett 2006).

US private lands, meanwhile, vary tremendously in the restrictiveness of their forest practice policies and hence, in their approaches to compliance. In Washington and Oregon, Forest Practices Boards have been established to oversee rule enforcement. In the US Southeast, where forestry is governed by voluntary Best Management Practices, the focus is on monitoring voluntary compliance. A number of the Southeastern US case study states have developed monitoring systems for the implementation of best management practices. In many jurisdictions, however, private landowners may deny state foresters access to their properties thereby impeding the use of random sampling.

The Canadian case studies, in which forests are predominantly provincially owned, also vary in their approach to enforcement, although less than the US states. In British Columbia, under the 1995 Forest Practice Code, random and routine audits were conducted by the Compliance and Enforcement Branch of the Ministry of Forests, and annual reports, summarizing the results, were posted on the BC

government web page. In addition, an independent, non-governmental monitoring body, known as the BC Forest Practices Board, was established to carry out random audits and respond to complaints related to both private licensees and the Ministry of Forests itself. Only the relevant BC Ministries, however, hold the authority to administer penalties. With the recent change to a "results-based code", a new Ministry of Forests auditing system is under development, aimed at the systematic measurement of forest management impacts across the landscape.

The Ontario Ministry of Natural Resources focuses on rule compliance, the efficacy of the rules themselves, and their management impacts through a process of "independent forest audits." Independent forest audits are conducted by approved auditors every five years on all Crown (i.e. public) lands. The audit results are made publicly available, and forest licensees and the Ministry must prepare Action Plans to address any problems raised. Likewise, in Quebec, government audits address rule compliance, as well as the impacts of the rules themselves and resulting forest management activities. In Alberta, routine audits and formal public reporting were discontinued after 2002 to be replaced by more informal "field checks" without systematic reporting.

Developing countries are often at a distinct disadvantage in terms of the resources and capacity they have available for government-controlled enforcement mechanisms. As a very general indication of the relative performance of their environmental regulatory regimes, including but not limited to forestry, it is useful to draw on recent work of Dan Esty and colleagues (Esty and Cornelius 2002; Esty and Porter 2002). They have considered a range of criteria in developing an "index" of regime performance based on standards, implementation, enforcement mechanisms, and associated institutions with direct responsibility for pollution control and natural resource management. Figure 25 summarizes Esty and Porter's findings as they relate to our case study countries (excluding the Democratic Republic of Congo due to missing information).

Given the incredible complexity of the issues addressed in this index, there is no doubt considerable room for dispute over the precise ranking of each country. Nevertheless, a strong pattern can be observed in that developed countries show consistently higher regime ratings. Hence, in spite of the diverse mechanisms used to enforce governmental forest policies in lesser-developed countries, their effectiveness falls well short of compliance and enforcement efforts in Tasmania and the other developed country jurisdictions covered in this report.

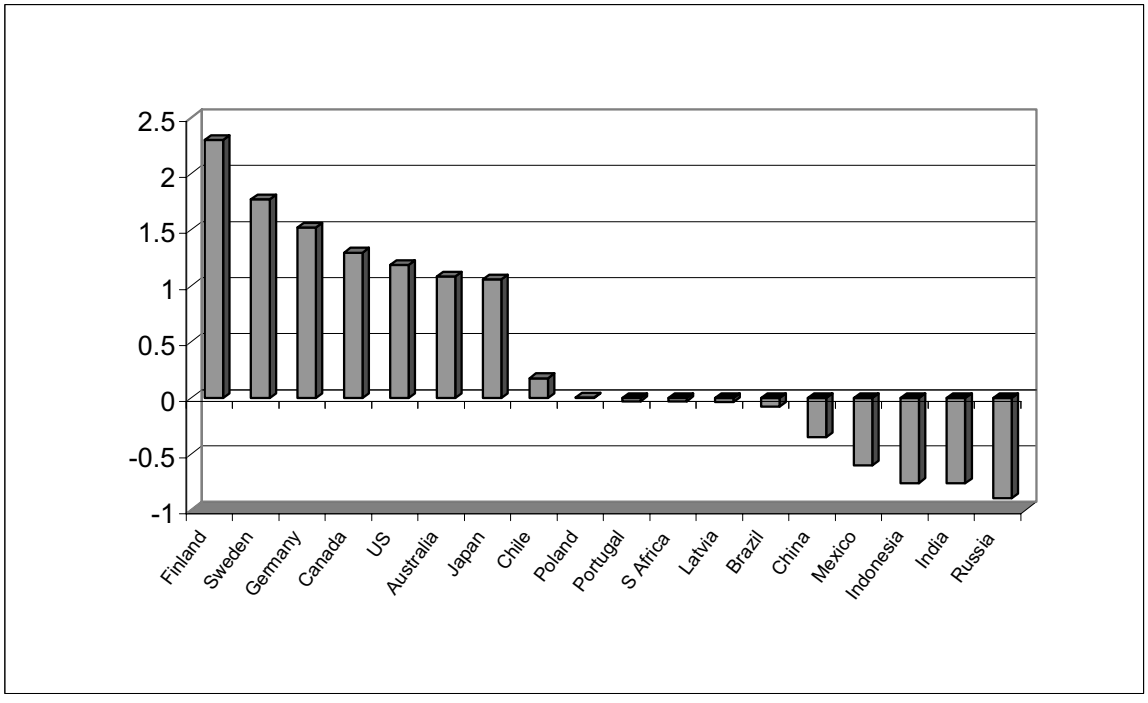

Figure 25. Environmental Regime Index. Source: Esty and Porter (2003).

Forest Certification

One of the most innovative policy approaches to promote sustainable forestry is found in the case of forest certification, which has emerged to address global and domestic forest challenges. Forest certification is an effort to recognize forest companies and government agencies that practice responsible forestry and to reward them with market access, potential price premiums, and the "social license to operate." For these reasons, while governments may be involved in the development of forest certification standards and dialogues, they do not require that companies adhere to the rules. Instead, the idea is that through the generation of abstract "good will" and more concrete preference on the part of the consumers and customers of forest products, firms will agree to abide by the standards of a particular certification system. Firms who agree to abide by the pre-established standards are then audited for compliance by a third party auditor. By altering purchasing decisions to demand responsibly harvested forest products, those championing certification are attempting to create a "win-win" situation for forest producers, the environment, and end users.

It is beyond this scope of this analysis to present a complete review of the complex and nuanced story of the emergence of forest certification across the globe or in Australia[18]. Instead, we present a snapshot of global dynamics, before turning to a brief description of the emergence of forest certification in Australia.

The Global Context: Origins and Two Conceptions

The first global scale forest certification program was spearheaded in 1993 by the World Wide Fund for Nature (WWF) and a coalition of environmental and socially concerned groups, who joined with select retailers, governmental officials, and a handful of forest company representatives to create the international Forest Stewardship Council (FSC). These groups were frustrated with the failure of intergovernmental efforts to develop a binding global forest convention at the 1992 Rio Earth Summit amidst increasing global forest deterioration. Initially, they were especially - but not exclusively – concerned about tropical deforestation. Their idea was to bypass governmental processes by turning to the market place and offering forest landowners and forest companies who practiced the FSC version of "sustainable forestry" a stamp of approval through the FSC-accredited certification process, thus expanding the traditional "stick" of a boycott campaign by offering "carrots" as well.

The FSC created nine "principles" (later expanded to 10) and more detailed "criteria" that are performance-based, broad in scope, and address tenure and resource use rights, community relations, workers' rights, environmental impact, management plans, monitoring and conservation of old growth forests, and plantation management (See Forest Stewardship Council 1999; Moffat 1998). The FSC created a "tripartite" governance arrangement with three chambers consisting of environmental, social, and economic actors, each with equal voting rights. Each chamber is itself divided equally between North and South representation (Domask 2003). The FSC mandated the creation of national or regional working groups to develop specific standards for their regions based on the broad principles and criteria.

The FSC version of forest certification has been criticized in two major ways. First, there were concerns on the part of domestic forestry agencies, forest owners, and industry associations that it was bypassing and/or ignoring the norm of national sovereignty – i.e. the idea that people within a certain territorially defined boundary have the right to decide for themselves how to govern without outside interference. Though the FSC did address this by requiring that national and sub-national multi-stakeholder bodies develop the specific rules, critics pointed out that only the international general assembly could alter the international principles and criteria upon which the standards were required to be based.

The second critique concerned the FSC governance structures. The lumping together in one chamber of those economic interests (i.e., companies and non-industrial forest owners) who must actually implement sustainable forest management (SFM) rules with

[18] For detailed reviews, see Cashore, Auld and Newsom (2004), Meidinger (2005), Cashore, Gale, Meidingern and Newsom, eds. (2006) and McDermott (2004).

companies along the supply chain who might demand FSC products, as well as with consulting companies created by environmental advocates, has been the source of much controversy and criticism. It has negatively affected forest owners' evaluations of the FSC (Rametsteiner 1999; Sasser 2002; Vlosky 2000), led them to believe they would have their independence and autonomy reduced, and encouraged the development of "FSC alternative" certification programs, which are now offered in all countries in North American and Europe where the FSC has emerged. In the US, the American Forest and Paper Association created the Sustainable Forestry Initiative (SFI) certification program. In Canada, the Canadian Standards Association (CSA) program was initiated by the Canadian Sustainable Forestry Certification Coalition, a group of 23 industry associations from across Canada (Lapointe 1998). And in Europe, following the Swedish and Finnish experiences with FSC-style forest certification, an "umbrella" group, initially known as the Pan European Forest Certification (PEFC) system, was created in 1999 by European landowner associations that felt excluded from the FSC processes. However, by 2001, global interest in creating an umbrella system that could house all global competitor schemes emerged as well.

Forest Certification in Australia

Like the story elsewhere, the emergence of forest certification in Australia is complex and dynamic. For the purposes of this report, we will review overall trends and approaches, which will, necessarily, gloss over important elements that our future research efforts are being designed to address.

The Forest Stewardship Council

The emergence of, and support for, the FSC in Australia was unique compared to most countries, because many Australian environmental groups championed the FSC for use on *plantations*, rather than natural forests. This approach, these groups explained, was consistent with environmentalist efforts to stop all harvesting of *remaining* natural forests (Cadman 2002)[19]. Having made the strategic decision to focus much of their campaigning effort on stopping both the harvesting of natural forests and the conversion of natural forests to faster growing plantations, environmental groups decided that they should promote harvesting in forestlands that were already converted, in order to achieve this goal. Importantly, following the FSC's international requirement that only forest lands converted to plantations before 1994 would be eligible for FSC certification (Cadman 2002)[20], Australian environmental groups focused on promoting the FSC as a way of giving international recognition to firms operating on plantations that were converted before 1994 – in effect driving a wedge between plantation-focused forest companies, determined by the date at which their forests happened to be converted. This also divided forest companies harvesting on plantations from those harvesting in natural forest lands (even if they were not converting them to plantations).

Partially because of this effect, relatively few firms in Australia currently support the FSC (Fisken 2003). One prominent example, however, is found in the case of the US timber investment giant, Hancock Resources Ltd, which practiced plantation forestry on lands converted before 2003 (Canada NewsWire 2001). Hancock had already undergone FSC certification on some of its US forest lands, reasoning that where it was already practicing at, or close to, the requirements of the FSC system, it made good business sense to support the FSC – especially because doing so reduced its "risk" of being targeted by transnational environmental campaigners (Cashore, Auld, and Newsom 2004). Subsequently, a number of other Australian forestry companies have sought and achieved FSC certification for their plantation forests.

[19] As of 2004, the WWF and Wilderness Society have accepted some logging on natural forests when accompanied by the "setting aside" of untouched forests elsewhere. (Australian Government Forest and Wood Products Research and Development Corporation. 2005. The Sustainability Challengefor Australia's Forest Products Industry adn Society.) Greenpeace adn ACF remain opposed to any logging on natural forest lands.

[20] The logic behind this regulation was that FSC did not wish to encourage the conversion fo natural forests but did not recognize the role of plantations in supplying consumer demand, hence reducing pressure elsewhere.

Support for the PEFC/ the Australian Forestry Standard (AFS)

As in countries in Europe and North America, the emergence of and debates over the FSC sparked both interest and concerns in the idea of forest certification and the FSC approach amongst Australian forest stakeholder. In contrast to FSC "competitor" programs in Europe that were inspired in part by environmental brand-attack campaigns (Cashore, Auld and Newsom 2004), Australian government agencies and forest industry associations supported certification in the absence of such pressure. Instead, the development of an Australian national standard was motivated by government and industry interest in promoting Australia's sustainable forest management credentials to the Australian public and to export markets. Hence, an increasing domestic focus on Australian forestry practices fostered by environmental groups, combined with efforts to promote the sustainability credentials of Australian forestry and forest products (Australian Government Forest and Wood Products Research and Development Corporation 2005), and signals of international market interest in certified products (Ozanne and Bigsby 2003), to create the background conditions through which concerted efforts were made to develop a "made in Australia" certification standard, known as the "Australian Forestry Standard."

Mirroring the Canadian and European approach, the AFS standards were developed at the initiative of the forest industry and government, in this case through the formal "Australian Standard" development process overseen by Standards Australia (Standards Australia 2006). Under this process, AFS Ltd. was accredited as a standard development organization by Standards Australia, and the AFS development process and its outcomes were reviewed by Standards Australia. The AFS was formally accredited by Standards Australia in 2003 (JAS-ANZ 2006), and Gunns Ltd. became the first company in Australia to be certified under the AFS in November 2003 (Australian Forestry Standard Ltd. 2004).

A number of Australian environmental NGOs were reluctant to participate in the AFS development process and subsequently withdrew themselves, criticizing the program for legitimizing existing practices, including ongoing conversion of natural forest (e.g. Arts 2004; The Wilderness Society et al. 2005; WWF Australia 2002).

Proponents of the AFS have been equally strong in its defense, arguing that the AFS is both a credible and a useful tool for demonstrating and communicating responsible forestry in the Australian context (Australian Forestry Standard 2006; Australian Government Forest and Wood Products Research and Development Corporation 2005; NAFI 2005). In many respects, the debate over the AFS mirrors that over certification schemes more generally (e.g., FSC Watch 2006; PEFCWatch 2006).

The future of forest certification in Australia is still highly dynamic, as debates continue to occur domestically about the most appropriate pathway for forest conservation. At the same time, domestic market pressure remains fairly limited, in contrast to increasing international market pressure experienced by, particularly, Tasmanian forestry businesses. While the adoption of certification in Australia has been slow compared to that in many comparable countries (see Figures 26-28), the Australian industry – led in many respects by a proactive Tasmanian forest sector – has continued to promote a "made in Australia" certification program. Indeed, by the end of 2004, the AFS was formally "mutually recognized" by the PEFC (Australian Government Forest and Wood Products Research and Development Corporation 2005).

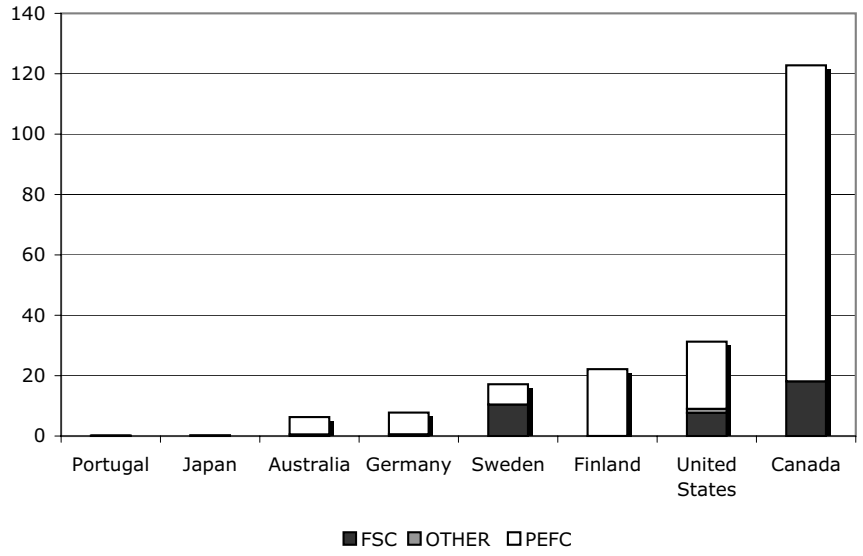

Figure 26. Forest area certified (million ha) in case study OECD countries*

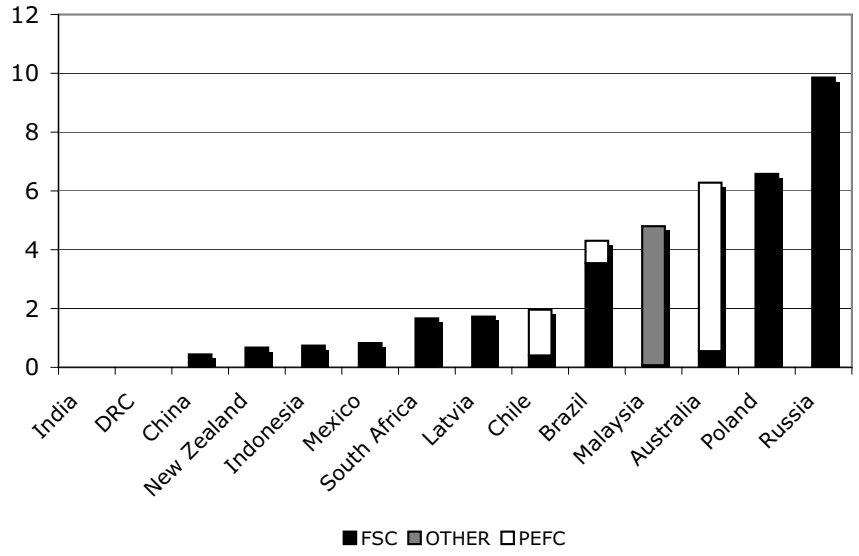

Figure 27. Forest area certified (million ha) in Australia and lesser developed case study countries*

* While the case study countries vary considerably in their total forest area, it is clear form these charts that the area certified is not closely correlated with total forest area. It is also clear that, on average, the developed case study countries have adopted certification at a much more rapid rate. Finally, it should be noted that much of the forest area in Australia is not suitable for commercial timber production. There are no global data available, however, on the percentage of productive timberland certified.

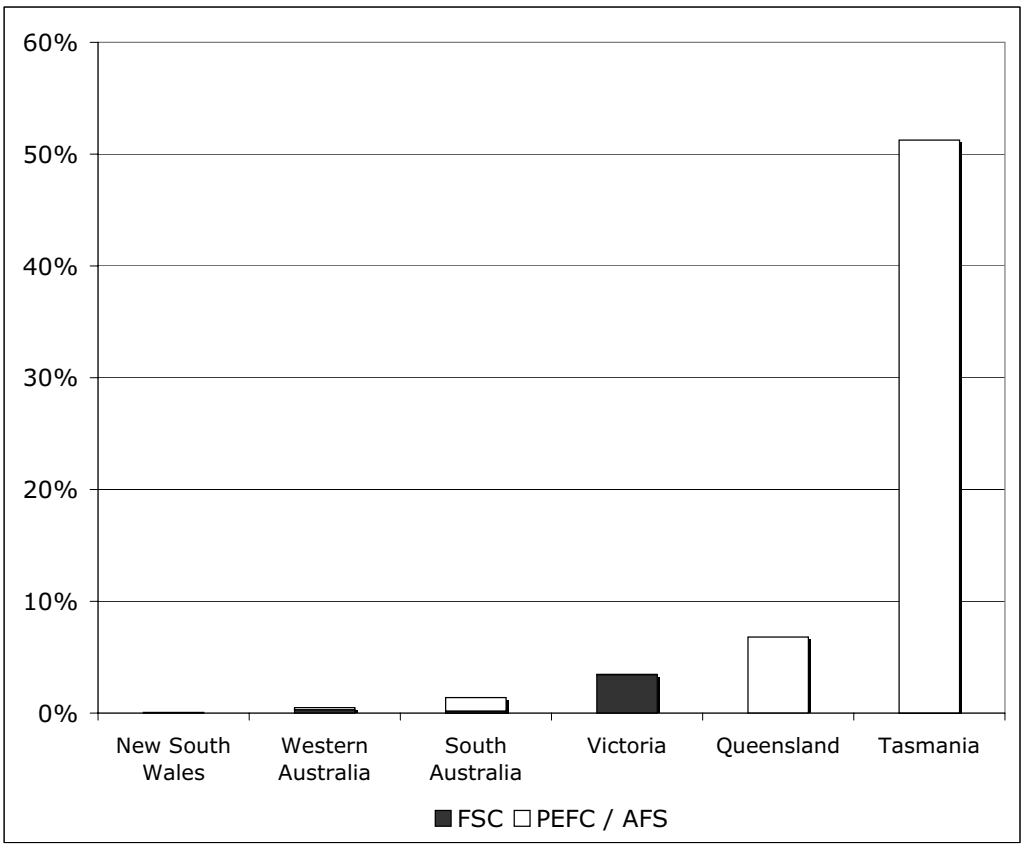

Figure 28. Percentage of forest area certified by Australian state*

*States vary considerably in both size and the relative percentage of forest area that is covered by productive timberlands.

Summary, Conclusions, and Further Research

Forest governance today in Tasmania, across Australia, and around the world is an indisputably complex and multi-faceted endeavor. Nevertheless, the making of both state and non-state forest policy can and must be understood within a dynamic global context. In order to enhance transparency amidst this complexity, this report has presented a systematic analysis of environmental forest policies in twenty key countries and thirty-eight jurisdictions worldwide, using Tasmania as a constant case comparison. This comparison reveals the considerable diversity between jurisdictions and between key issue areas within the same jurisdictions. Nevertheless, by applying a triad of methodologies - i.e. policy classification, comparison of threshold requirements, and/or qualitative discussion - it has been possible to shed considerable light on the diverse and often highly detailed policies that are now in place.

In summarizing our results, let us first return to the five forest practices criteria with which we began this comparison. Tables 9-12 provide an overall ranking of the level of prescriptiveness of policy approach in each of our case study jurisdictions in regards to all five of these key environmental policy criteria.

For Tasmania, our constant case comparison, we address forest policies on both public and private lands. Within the state of Tasmania, these two land ownership types are similar in terms of their total land area and production levels, and there are expectations of major growth in private plantation production over the next twenty years (Parsons, Gavran, and Gerrard 2004). For the rest of the case studies, we address the forest ownership types that cover the largest natural forest area and/or produce the greatest volume of wood from natural forests within their jurisdiction. It is important to keep in mind that rules in many jurisdictions vary among landownership types, and there are landownership types not represented in the tables for which the regulations may be either more or less prescriptive.

Table 9 compares Tasmanian polices with other selected OECD jurisdictions outside of the US and Canada. The left hand column assigns a "level of prescription" from 0 to 10 based on the sum of all five criteria, ranked as indicated in the table key. Zero indicates that forest managers are allowed complete discretion and ten indicates that precise management actions are prescribed for all five criteria. The ranking of "0.5" is assigned to voluntary policy guidelines to reflect their potential role in mediating legal liabilities[21].

Among the OECD jurisdictions, Tasmanian public forestlands account for the most consistently prescriptive policy approach across all five criteria. Tasmanian private forestland policies are prescriptive across four out of the five policy criteria, but contain no prescriptions for AAC. Table 10 compares Tasmania with the US and Canadian case study jurisdictions.

Tasmanian public forestlands again rank in the most prescriptive category of these jurisdictions. In comparison with the Canadian provinces, Tasmanian public forestland policy is as consistently prescriptive as BC or Alberta and more consistently prescriptive than Ontario and Quebec. The comparison of Tasmania with the US varies much more markedly depending on the state and ownership in question. Private lands in California and federal US Forest Service lands are governed by forest policies as prescriptive as those governing Tasmanian public lands. Washington and Oregon rank equally with Tasmanian private forestlands across all criteria, while private lands in the US Southeastern states either rely on voluntary policy recommendations or provide no official guidance of any kind.

The comparison of Tasmanian forest policies with lesser-developed countries is a much more problematic endeavor, due to very different capacities for enforcement. The Enforcement and Compliance section of this report highlighted recent research attempting to quantify the relative effectiveness of environmental regimes in key countries around the world. While no doubt the sheer complexity of issues involved undermines the precision of such measurement, nevertheless the OECD case study countries outperform all lesser developed case study countries (Esty and Cornelius 2002).

[21] Under the US Water Quality Act, for example.

Level of Prescription (1-10)	Case Study	1) Riparian	2) Clearcuts	3) Roads	4) Reforestation	5) AAC
9	**Tasmania** (Public)					
8	**New South Wales** (Public)					
	Tasmania (Private)*					
6	**New Zealand** (Private)					
5	**Sweden** (Private)					
	Bavaria (Private)					
4	**Finland** (Private)					
	Japan (Private)					
1.5	**Portugal** (Private)					

	Non-Discretionary/Substantive (ranking: 2)
	Mixed: Government Discretion &/or Limited Forest Area/ Substantive (ranking: 1)
	Mandatory Procedural (ranking: 1)
	Discretionary (ranking: 0.5)
	No rules (ranking: 0)

Table 9. Relative levels of policy prescription in case study OECD jurisdictions, except the US and Canada

* Tasmania is the only case study in which two different land ownership types are addressed. Other case study land ownerships that do not account for the largest forest area and/or greatest volume of wood production in their jurisdiction, and hence are not addressed in this table, may be governed by policies that are either more or less prescriptive.

With such a perspective in mind, let us now turn to Table 11 comparing Tasmania with the Central and Eastern European cases.

Public forest policies in Tasmania and Russia emerge as the most consistently prescriptive. According to Esty and Cornelius' environmental regime index, however, Russia has the least effective environmental governance system (Esty and Cornelius 2002). Tasmanian forest policy on both public and private lands is more consistently prescriptive than the policies for Latvia private and Poland public forestlands.

Finally, Table 12 compares Tasmania with developing country jurisdictions. Tasmanian public and private forest policy is more consistently prescriptive than those of the developing country case studies. On the whole, these lesser-developed jurisdictions rely more heavily on planning and procedural approaches than is common elsewhere. In comparison with the average

Level of Prescription (1-10)	Case Study	1) Riparian	2) Clearcuts	3) Roads	4) Reforest-ation	5) AAC
9	**Alberta** (Public)					
	British Columbia (Public)					
	California (CA private forests = 43% of forest area; 89% of harvest)					
	Tasmania (Public)					
	USFS Lands (Forest Cover = 75% ID; 27% MT; 9% AK; 48% OR; 37% WA; 43% CA. Harvest = 9% ID; 4% MT; 9% AK; 5% OR; 1% WA; 8% CA)					
8	**Ontario** (Public)					
	Quebec (Public)					
	Tasmania (Private)					
	Washington (WA private forests = 45% of forest area; 80% of harvest)					
7	**Oregon** (OR Private forests = 36% of forest area; 85% of harvest)					
5	**Idaho** (ID private forests = 15% of forest area; 75% of harvest)					

Table 10. Relative levels of policy prescription in Tasmania and case study US and Canadian jurisdictions

4	**Alaska** (AK private forests = 28% of forest area; 86% of harvest)					
2.5	**Montana** (MT Private forests = 27% of forest area; 82% of harvest)					
2	**Louisiana** (Private)					
	Virginia (Private)					
1.5	**Arkansas** (Private)					
	Georgia (Private)					
	South Carolina (Private)					
1	**Alabama** (Private)					
	Mississippi (Private)					
	North Carolina (Private)					
	Texas (Private)					

	Non-Discretionary/Substantive (ranking: 2)
	Mixed: Government Discretion &/or Limited Forest Area/ Substantive (ranking: 1)
	Mandatory Procedural (ranking: 1)
	Discretionary (ranking: 0.5)
	No rules (ranking: 0)

Table 10 cont.

* Tasmania and the western US states are the only case studies for which two landownership types are addressed. US Forest Service lands in the western states cover a large area but private lands produce a greater volume of wood. Other case study land ownerships may be governed by policies that are either more or less prescriptive.

Level of Prescription (1-10)	Case Study	1) Riparian	2) Clearcuts	3) Roads	4) Reforest-ation	5) AAC
9	**Russia** (Public)					
	Tasmania (Public)					
8	**Tasmania** (Private)					
7	**Latvia** (Private)					
	Poland (Public)					

	Non-Discretionary/Substantive (ranking: 2)
	Mixed: Government Discretion &/or Limited Forest Area/ Substantive (ranking: 1)
	Mandatory Procedural (ranking: 1)
	Discretionary (ranking: 0.5)
	No rules (ranking: 0)

Table 11. Relative levels of policy prescription in Tasmania and Central and Eastern European countries

* Tasmania is the only case study in which two different land ownership types are addressed. Other case study land ownerships that do not account for the largest forest area and/or greatest volume of wood production in their jurisdiction, and hence are not addressed in this table, may be governed by policies that are either more or less prescriptive.

OECD jurisdiction, however, the developing country case studies are more consistently prescriptive. In other words, a lack of enforcement capacity does not appear to discourage the development of policy prescriptions.

In terms of threshold requirements for riparian zones, clearcutting, and road specifications, Tasmanian policy most closely resembles the policies of the western US and Canadian case studies. The thresholds are significantly more modest than those of New South Wales and much more restrictive than those of the US Southeastern states. By far, the most restrictive threshold requirements are found in developing countries and countries in economic transition, where government enforcement capacity is lowest.

Tasmanian forest policy for private lands is more prescriptive than that of many other case studies. In Tasmania, AAC is the one forest policy criterion for which there are no prescriptions pertaining to private lands. Among our case study jurisdictions, only New Zealand and California apply mandatory substantive AAC policies to privately owned natural forestlands.

In addition to the five forest practice criteria of riparian zones, clearcutting, road building, reforestation, and AAC, we also analyzed case study approaches to broadly defined, cross-cutting themes of environmental governance. These were plantation management (plantation growth and environmental policy), biodiversity protection (protection of species at risk and protected areas), compliance and enforcement (mechanisms for monitoring and oversight), and forest certification (its development as a new form of non-state environmental governance).

In regards to plantations, five countries – China, India, Russia, the US, and Japan – account for nearly two-thirds of the world's forest plantation area. India, China, and Japan place the strongest focus on non-industrial plantations aimed at environmental

Level of Prescription (1-10)	Case Study	1) Riparian	2) Clearcuts	3) Roads	4) Reforest-ation	5) AAC
9	**Tasmania** (Public)					
8	**Tasmania** (Private)					
7	**Indonesia** (Public)					
	Mexico (Communal)					
6	**Chile** (Private)					
5	**Brazilian Amazon** (Private)					
	Madhya Pradesh (Public)					
	South Africa (Public)					
Data Incomplete	**China** (Public)	N/A		N/A	N/A	
Data Incomplete	**DRC** (Public)		N/A	N/A		

	Non-Discretionary/Substantive (ranking: 2)
	Mixed: Government Discretion &/or Limited Forest Area/ Substantive (ranking: 1)
	Mandatory Procedural (ranking: 1)
	Discretionary (ranking: 0.5)
	No rules (ranking: 0)
N/A	Data missing (ranking: N/A)

Table 12. Relative levels of policy prescription in Tasmania and developing country jurisdictions

* Tasmania is the only case study in which two different land ownership types are addressed. Other case study land ownerships that do not account for the largest forest area and/or greatest volume of wood production in their jurisdiction, and hence are not addressed in this table, may be governed by policies that are either more or less prescriptive.

protection and/or improving rural livelihoods. Plantations in the US, in contrast, have been almost exclusively developed for production purposes (FAO 2005) and are subject to relatively few environmental constraints. Across all of our case studies, environmental protection policies related to plantations are either the same or less prescriptive than they are for natural forests. The most detailed plantation policies are found in Tasmania, the other Oceanic case studies, and South Africa.

Tasmanian regulations protecting endangered species are among the most prescriptive. Species at risk, including vertebrate and invertebrate animals, vascular plants, and lower plants such as mosses and lichens, as well as their habitats, are afforded special protection.

In regards to protected areas, there are a lack of reliable, global-scale sub-national data that would allow a comparison of Tasmania with other sub-national jurisdictions. If one compares Tasmania with other case studies at the national level, however, in 2006, Tasmania contained the most area protected under IUCN categories I and II. As of 2006, 40.2% of Tasmania's land area was protected in formal reserves across six IUCN categories. This large percentage of protected areas is well above the global average.

Under both the RFA and TFCA processes, the Tasmanian reserve system was expanded according to the Australian "comprehensive, adequate and representative" criteria (Australia and Tasmania 2005a: Table 1). Some conservation groups (e.g. The Wilderness Society 2005) remain critical of the distribution of Tasmanian reserve systems across different habitat types and different regions of the state. Meanwhile, other groups (e.g. WWF Australia 2006) have shifted their focus to agricultural and coastal zones.

The enforcement of Tasmanian forest practice regulations is governed by the Forest Practices Authority (formerly the Forest Practices Board). Both random and targeted audits are conducted by Forest Practice Officers and Authority staff, and the Forest Practices Authority holds the power to de-certify Forest Practice Officers (FPA 2006). This type of systematic auditing is not uncommon in developed countries. However, on private lands in New South Wales and the US Southeastern states, where forest policies are primarily voluntary, state monitoring efforts may not be backed by enforcement mechanisms. In some US Southeastern states, furthermore, private landowners may deny state foresters access to their property. Our lesser-developed case study countries generally lack state capacity to consistently enforce their environmental policies.

With respect to forest certification, we found a highly dynamic environment in which there are active protagonists of both the globally-focused and environmental group-initiated Forest Stewardship Council (FSC), and the nationally-focused and domestically-initiated (but now PEFC-endorsed) Australian Forestry Standard (AFS). The FSC's rule that no forest lands converted to plantations after 1994 are eligible for certification has exacerbated the differences between the two schemes, with some Australian plantation forestry firms seeking and securing FSC certification and, conversely, many Australian state forestry agencies and other firms, including Forestry Tasmania and Gunns Ltd., successfully seeking certification of their forest lands under the AFS. Further research needs to be undertaken to assess the potential of forest certification as a tool to promote sustainable forestry in Australia and to communicate the quality of Australian forestry practices to national and international audiences.

Our systematic classification and assessment of global environmental forest policies has revealed considerable policy variation. In terms of on-the-ground forest conservation, however, the most important question still remains—i.e. how effective are these policies in achieving their environmental goals?

This overarching question suggests numerous areas for further research. For example, research is needed to determine when prescriptive versus procedural policies are most effective for achieving forest management objectives. Likewise, field-based studies are required to better understand the conditions under which forest-related legislation and accompanying regulations serve to enable or constrain efficient and effective planning and implementation. Research is also needed to determine how to maximize the influence of policy factors, such as landownership, economic development, civil society involvement, etc., on policy outcomes. Our classification framework sets the stage for such research by introducing a common policy language with which to articulate the different policy choices of both state and non-state governance systems.

The need for international comparative research on this topic has never been greater, nor have the opportunities to undertake such research been more pronounced. Increasing globalization, along with expanding communication abilities and rising technological capacities, both demand and enable global-scale policy learning. Such learning can go a long way towards transforming forestry debates from acrimonious declarations and denials to more problem-focused dialogue and collaboration.

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