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## Does forest certification matter? An analysis of operation-level changes required during the SmartWood certification process in the United States

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### Abstract

One controversial and contested issue concerning forest certification is whether this market-based instrument actually requires participating forestry operations to follow more sustainable practices. While previous studies have explored and compared the standards used by different certification systems, our research sheds additional light on this question by systematically assessing documented conditions and pre-conditions that forest companies seeking FSC certification in the United States were required to address in order to obtain, or maintain, their certificates. We examined the changes that 80 SmartWood-certified forestry operations were required to make to forest management, ecological, social, and procedural elements of their forestry practices as a requirement of the certification process. We found that systems elements such as Management Plans, Monitoring and Inventory most frequently required change (by 94%, 79% and 71% of certified operations, respectively), followed by ecological elements such as High Conservation Value Forests and Woody Debris, Snags and Legacy Trees (by 71% and 63% of operations, respectively). We also found regional differences in the number of changes operations are required to make during certification, and found that operations located in states with mandatory Best Management Practices (BMPs) are required to make fewer changes during the certification process than those in states where BMPs are voluntary. We found that small and large operations were given roughly the same number and type of conditions and preconditions. Overall the results show that even the early adopters of certification were required to make important changes as a result of the certification process.

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## 1. Introduction

One important question for forest certification systems is whether they are able to promote effective solutions to persistent and pressing environmental policy problems. Does forest certification lead to changes in “on-the-ground” forest management that reduce potentially negative impacts of forestry operations on species habitat, riparian zones, and other values? Or does forest certification simply legitimize the status quo? This paper examines these questions by analyzing the “conditions” and “preconditions” that a leading Forest Stewardship Council (FSC) auditor, the SmartWood program of the Rainforest Alliance, placed on those companies and land owners seeking forest certification in the United States.

We present our analysis in three steps. First, we discuss the challenges involved in assessing the impacts of certification. Second, we review our research design and methodology. Third, we discuss the results and implications for the effectiveness of forest certification in promoting sustainable forestry.

## 2. Challenges for analyzing an ever changing environment

Any analysis of on-the-ground impacts of forest certification is challenging for two reasons. First, there are a number of different certification standards. Within the United States alone, the FSC, the Sustainable Forestry Initiative (SFI), The American Tree Farm System (ATFS) and Green Tag differ in terms of standards content and the certification process. And perhaps most importantly, nuances among standards change over time, as they incorporate new information or, sometimes, compete with each other for legitimacy in the marketplace (Cashore et al., 2004). Second, everything else being equal, the most progressive firms are most likely the first ones to pursue certification (Hayward and Vertinsky, 1999). This means that the operations whose practices could most be improved by certification may be the least likely to join.

Given these caveats, however, our analysis is important because if certification is indeed dealing with the most progressive forestry operations, then we would expect the impact of forest certification to

be even greater in the future than what our current results show. That is, a reasonable hypothesis is that any changes found in this analysis are a conservative estimate of what changes might occur in the long run, if the FSC or equivalent certification systems were to gain greater support from forest owners.

## 3. Previous research

Previous attempts to assess the potential effects of certification or the relative merits of different programs have been hindered by a lack of on-the-ground information and/or small sample sizes. Some studies have analyzed one or more program’s standards, often involving a “checklist” (CEPI, 2001; Meridian Institute, 2001; FERN, 2004) but these projects have not determined if and how those standards are applied to individual operations. Also, the binary nature of yes/no categories sometimes fails to capture the nuanced differences between standards.

Other projects aimed at assessing the effects of certification are based on informative but small sample case studies (Cubbage et al., 2003; Cashore et al., *in press*). Research projects have examined the effects of certification in countries as diverse as Bolivia, Honduras and Mexico (Markopoulos, 2003), and Indonesia, Russia and Brazil (Richards, 2004). By their very nature, however, these case studies explore the depth of certification in a few regions but do not answer broader questions about certification’s cumulative effects over larger areas.

## 4. Approach

In this paper we assess certification’s impacts by examining the changes that the SmartWood program of the Rainforest Alliance, an FSC-accredited certifier, has required of those US forestry operations seeking certification. We also determine whether certain *types* of forestry operations are required to make changes to their forest practices as a result of the certification process more often than others. Specifically, we determine whether the changes associated with certification accrue differently among small and large ownerships, ownerships located in different US FSC standards regions, and ownerships located in states where For-

estry Best Management Practices are voluntary versus mandatory.

Our focus on only the FSC has strengths and weaknesses. While we are unable to compare or contrast the changes required during FSC certification with those required under other certification systems, we are able to focus on some important questions within the FSC. Moreover, as a program with a diverse membership and support base, we are able to assess the ability of this system to address many of the issues, albeit in the short term, that its supporters hoped it would. The fact that most other certification programs do not make their operation-level assessment results publicly available, and that they often use a simple pass/fail approach to assessments, also make the FSC a good choice for such an analysis.

Most importantly, while our operation-specific approach to understanding change is more time-consuming and complex than a checklist approach, and less extensive than a case study, it is important for three reasons. First, it uses empirical data from actual certified operations, allowing us to create a picture of what is happening on-the-ground. Second, with governments in some countries actually reducing regulatory requirements for certified operations (Quevedo, *in press*), there is a need to better understand how certification intersects with existing regulatory structures. In this project we look specifically at the relationship between certification and Forestry Best Management Practices. Third, while this analysis applies only to FSC-certified operations audited by SmartWood, it sets the stage for a future comparative assessment of different certification programs' effects.

## 5. Objectives and methods

We examined the changes that SmartWood forest certification assessors required each certified operation in the US to make as a precondition or condition of becoming certified. A precondition is a change that must be made before a certificate is granted, while a condition is a change that must be made within a given time period after the certificate is granted, usually 1 or 2 years. Guidance given to SmartWood assessors in the SmartWood Assessor Manual outlines that preconditions and conditions should both be reserved for serious infractions that, if not corrected,

will result in suspension or termination of the certificate. For example, the manual says that “Preconditions are issued where major, fundamental weakness is documented in the operation,” and that “Conditions relate to *significant* shortcomings in an operation that, if not met on the agreed upon timetable, will result in suspension or termination of certification” (SmartWood, 2003). Less significant shortcomings are addressed in non-binding recommendations, which were not included in this analysis.

In total, we examined 44 preconditions and 1076 conditions, coming from 80 forestry operations. Chi-squared tests revealed that preconditions and conditions did not differ significantly in terms of the thematic areas they addressed, which prompted us to lump preconditions and conditions together in the analyses. For the seven operations that had undergone a 5-year reassessment at the time of analysis, we included the preconditions and conditions from both assessments. Preconditions and conditions are both referred to as “conditions” hereafter for simplicity.

Once conditions are written into an assessment report, FSC auditors conduct annual audits to ensure that conditions are met in the field within the required timeframe. By including in our analysis only those 80 forestry operations in the U.S. that had “active” SmartWood certificates as of October 1, 2003, we eliminated all operations that had not passed their annual audits, were suspended for non-compliance or voluntarily withdrew from certification. Each operation's conditions are listed in its public summary report, available on the Rainforest Alliance website.

For our analysis, each condition was read and categorized according to a predetermined set of 34 “thematic areas”. Thematic areas are listed in Table 1, and are grouped for convenience into the categories of Forest Management Activities, Forest Ecology Elements, Social and Economic Elements, and Systems Elements. Because FSC certification in the US is done using a number of different regional standards (or generic standards before regional standards are finalized), it was not feasible to designate thematic areas that corresponded to specific FSC criteria and indicators. The final list of thematic areas was created by the authors in consultation with certification assessors and other experts, with the goal of covering all forestry topics that could potentially be affected during an assessment. In our analysis, an operation was deemed

Table 1  
Forest and forestry elements examined for each condition

Forest management activities	Forest ecology elements	Social and economic elements	Systems elements
Roads and skid trails	Soil and erosion	Communication and conflict resolution with stakeholders, neighbors and communities	Management plan
Restoration	Aquatic and riparian areas	Special cultural sites	Harvest plan
Regeneration and reforestation	Threatened and endangered species	Worker wages and living conditions	Monitoring
Conversion to non-forest uses	Other wildlife	Worker safety	Inventory
Chemical use and disposal	Sensitive sites and high conservation value forests	Training	Mapping
Rate of cut	Woody debris, snags and legacy trees	Illegal activities and trespassing	
Exotic species and pests	Set-asides, reserves and representative ecosystems	Compliance with state, federal and international laws (including state BMPs)	
Fire	Landscape-level considerations	Profitability of operation	
Clearcut use and size	Use of lesser known species	Long-term tenure	
	Non-timber forest products	Chain of custody	

to have made a change in a given thematic area if it was given at least one condition relating to that area.

Once we identified which thematic areas were addressed in each condition, we looked for relationships between the characteristics of the forestry operations and the changes they were required to make. The explanatory variables we chose to examine included operation size, FSC standards region, and the presence of voluntary or mandatory state-level forestry Best Management Practices. Operation size (in ha) was thought to have potential explanatory power due to the conventional wisdom that landowners with smaller holdings tend to have fewer resources to devote to key forestry systems elements such as monitoring and inventories, and a lower ability to undertake landscape-level activities.

SmartWood-certified forestry operations fell into the following US FSC Standards Regions: Appalachia, Northeast, Lake States, Pacific Coast, and Southeast. Because the FSC delineated these standards regions primarily on ecological and forest cover type boundaries (Ervin and Pierce, 1996) we felt that this variable would most easily allow us to explore the degree to which the changes required during certification vary among forest ecosystems.

Finally, we examined whether forestry operations located in states with mandatory Forestry Best Management Practices were required to make different changes than those operations located in states with voluntary forestry Best Management Practices. Because operations in states with mandatory BMPs

are required to comply with state-level standards regarding water quality and roads while operations in states with voluntary BMPs often face no legal requirements beyond compliance with the Clean Air and Clean Water Acts, we suspected that operations located in states with voluntary BMPs would have conditions that required them to address thematic areas involving water, riparian areas and roads more often than those in states with mandatory BMPs.

We tested each of the three explanatory variables individually against the 34 binary dependent variables. For each of the 34 thematic areas, the binary dependent variable was the presence or absence of at least one condition. Of the three explanatory variables, operation size was continuous, while FSC standards region and voluntary or mandatory BMPs were categorical, requiring different statistical tests. For each thematic area, we used a *t*-test when comparing the size of operations with and without conditions. We used an analysis of variance to compare the average size of certified operations in different regions. In both analyses, size was log transformed to approximate a normal distribution. We used Fisher's exact test (with Bonferroni-corrected pairwise comparisons) when testing FSC standard region and voluntary or mandatory BMP against our dependent variables. Fisher's exact test is more accurate than a Chi square approximation (Zar, 1996). Multiple logistic regressions (Neter et al., 1990) or classification trees (Breiman, 1984) would have been prefer-

able for modeling several explanatory variables simultaneously but their results were not robust due to our sample size.

In addition, we used the number of conditions given to each operation and the number of thematic areas addressed by each operation as dependent variables. We used general linear models with a Poisson link to regress these two dependent variables on the three independent variables described above. Count data generally follows a Poisson rather than a normal distribution (Zar, 1996). The general linear model with Poisson link is the equivalent statistical technique for count data to a regular regression for normally distributed data.

All statistical tests were performed with the statistical package SPlus 6.1 and the additional libraries MASS, Hmisc, and Design. The probability of a type I error was set at  $\alpha=0.05$ .

The project has the following limitations. We did not consult audit reports to confirm that the conditions in the original assessment reports were actually met in the timeframe given by the assessors. However, given that the FSC requires annual audits, and that we included in the analysis only those operations that had passed their previous annual audit (i.e., had an “active” status, not “suspended” or “terminated”), the chances of including a condition in the analysis that was not met on-the-ground are relatively low.

Also, there are certain inherent weaknesses in the classification system we developed for this analysis. Subtle differences in the wording of conditions sometimes made assigning thematic areas difficult. However, we attempted to minimize this problem by conducting a “calibration” exercise beforehand, in which four people with extensive FSC certification experience assigned thematic areas to the same set of conditions and compared results, discussing any differences. One of these four individuals (and an author of this paper) performed the classification of all conditions used in this analysis.

Another weakness of the classifications system is that the precise wording of similar-sounding conditions often had potentially different on-the-ground repercussions for their respective forestry operations. For example, the two conditions “Increase riparian buffer zone width to 30 m” and “Implement a process for determining the appropriate riparian buffer zone

width” would have both been assigned to the thematic area “Aquatic and Riparian Areas.” However, in reality these two conditions may lead to very different buffer zone widths, depending on the outcome of the process required in the second condition. Therefore, we emphasize that the results of this analysis represent broad trends and not a definitive treatment of certification’s specific impacts.

Our analysis assumes that it is important to distinguish procedural criteria whose effect on on-the-ground forest management is indirect, such as management planning documents and monitoring programs, from more direct criteria relating to actual forest management practices. Recognition of this distinction is not to argue that one approach is necessarily better than the other is but that they do have different effects on policy choices.

One debate among industry and environmental groups is whether criteria should be general and relatively abstract, or concrete and requiring immediate on-the-ground action. Scholarly work seems to indicate that in the public policy realm, non-discretionary substantive standards gain the greatest degree of compliance (Tripp, 1994; Sharma, 1998; Sharma and Vredenburg, 1998), but could restrict proactive firm-level greening efforts by “straight-jacketing” operations (Porter and van der Linde, 1995; Zietsma and Vertinsky, 1999–2001; Cashore et al., 2001). SmartWood assessors strive to avoid that straight-jacket by focusing “on the end or product desired, not the means of getting there or the exact shape that the outcome should take” (SmartWood, 2003).

## 6. Results and discussion

### 6.1. Types of changes made

SmartWood-certified operations in the US were given, on average, 0.5 preconditions and 13.9 conditions during their initial certification assessment. The seven operations that had completed their 5-year reassessment at the time of analysis received an average of 0.4 preconditions during the reassessment, and 6.4 conditions. The fewest conditions given to any operation we examined was two, and the highest was 44. On average, operations were required to address 14 of the 34 thematic areas we examined.

In the US, certified operations are required to make changes to the systems elements of their operations most frequently<sup>1</sup> (Fig. 1). These include Management Plans (94% of operations required to make improvements), Monitoring (79%), Inventory (71%) and Mapping (69%). Prominent ecological issues were also addressed by a high number of operations, with 71% of operations requiring improvements in the thematic area Sensitive Sites and High Conservation Value Forests, and 63% in the areas of Threatened and Endangered Species, and Woody Debris, Snags and Legacy Trees. Conditions addressing social issues, such as Special Cultural Sites and Worker Safety, were generally given to fewer operations (35% and 30%, respectively), with no operations given conditions in the thematic area Worker Wages and Living Conditions.

The finding that certified operations in the US are required to improve ecological and systems elements much more frequently than social elements is consistent with the hypothesis put forth by some observers that forest certification standards in northern countries tend to focus more on ecological issues, while those of southern countries tend to focus on economic and social aspects (Ros-Tonen, 2004). In addition, northern countries tend to have more resources to devote to monitoring and other systems elements (Ros-Tonen, 2004). Future research based on the conditions given to operations in the SmartWood international portfolio will explore whether these hemispheric hypotheses hold true.

### 6.2. Effects of FSC standards region

The FSC standards region in which an operation is located significantly affected the number of thematic areas the operation is required to address and the number of conditions given during the certification assessment. Fig. 2 shows that the Southeast and Appalachia regions were given the most conditions and were required to address the highest number of thematic areas, while the Pacific Coast and Northeast regions were given the fewest conditions and required to address the fewest thematic areas, with the Lake

States falling in between. Pairwise tests revealed that the difference in number of thematic areas addressed by the Pacific Coast and Appalachian regions was statistically significant, as was the difference between the Northeast and Appalachian regions. Broadly, Fig. 2 shows that operations in the Southeast and Appalachian regions were required to make the most changes during certification.

There are a number of possible explanations for these differences. The results may mean that operations pursuing certification in the Pacific Coast and Northeast are already practicing forestry closer to the FSC bar than other regions and therefore were given fewer conditions and required to address fewer thematic areas. There is some evidence for this as research reveals that states in the Pacific Northwest and east are more regulated than those in the south (Ellefson et al., 1995, 1997a,b; Cashore and McDermott, 2004). Alternatively, differences in the number of conditions given may reflect regional differences in assessment teams' approaches to writing conditions; some assessors prefer to write a small number of conditions that each encompasses multiple themes, while others prefer to write many conditions that each deals with a single theme. The fact that many of the operations certified in the FSC's early years were certified to interim or generic standards means that we cannot draw conclusions about differences in standards' "stringency" from this analysis. In short, our results cannot be interpreted as meaning that the Appalachian and Southeast regions have tougher standards than other regions.

Many insights into the regional changes brought about by certification are gained through the examination of individual thematic areas. For 16 of our 34 thematic areas, Fisher's exact tests revealed significant regional differences in the percentage of operations given at least one condition. Table 2 shows these percentages and highlights the individual pairs of regions that were significantly different.<sup>2</sup> For example, the table shows that 90% of operations in the Pacific Coast were required to address the thematic area Wood Debris, Snags and Legacy Trees, versus 83% of operations in Appalachia, 42% in the North-

<sup>1</sup> Operations were deemed to have made a change in a given thematic area if they were given one or more conditions relating to that area.

<sup>2</sup> Note that all thematic areas included in Table 2 showed significant differences among regions overall, even if no specific pairs of regions were significantly different.

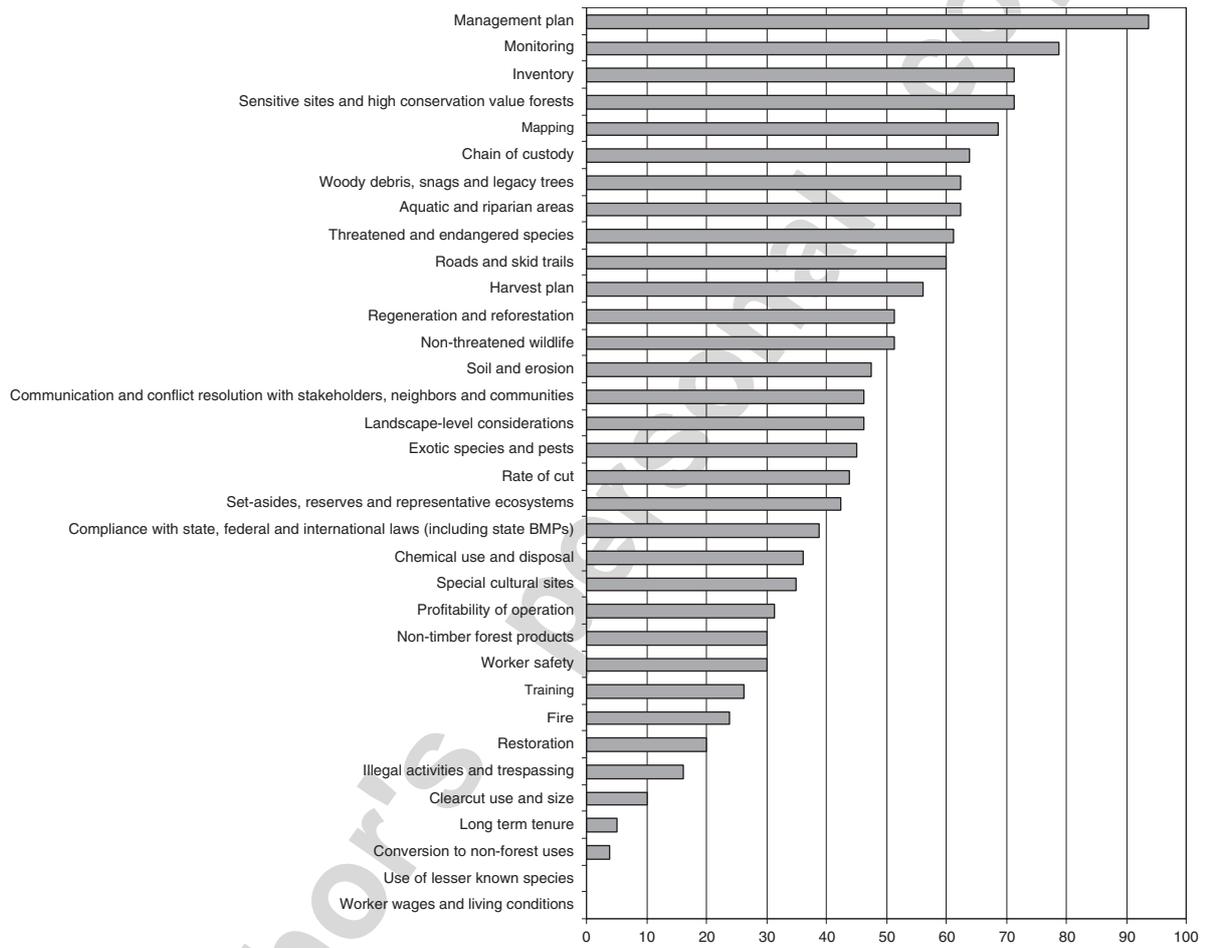


Fig. 1. Percentage of SmartWood-certified forestry operations given at least one condition, shown for each thematic area examined.

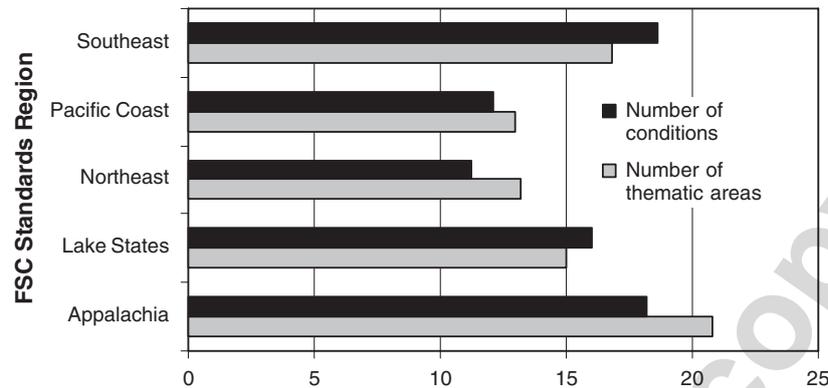


Fig. 2. For five FSC standard regions, the average number of conditions given and average number of thematic areas addressed by SmartWood-certified operations during their certification assessment.

east, 40% in the Lake States, and 38% in the Southeast. Testing individual pairs of regions showed that the percentage of operations making changes in the Pacific Coast is significantly different from the percentage making changes in the Northeast and Lake States.

Many of the differences observed in Table 2 may reflect the fact that operations located within the same standards region often share roughly similar ecological and forest cover characteristics, and a common

sociopolitical context. For example, the Pacific Coast region is known ecologically for its relatively large remaining areas of old growth forests on public lands, large timber volumes and high natural volumes of downed wood, and also for a history of conflict over forest use on both private and public forest lands. These ecological and historical realities are reflected in the types of changes that operations in the Pacific Coast are required to make, and may help explain why a relatively high percent of operations

Table 2  
For each thematic area, percentage of SmartWood-certified operations given at least one condition

Thematic area	Appalachia (%)	Lake States (%)	Northeast (%)	Pacific Coast (%)	Southeast (%)
Monitoring	83	50	65	93	100
Sensitive sites and high conservation value forests	100	70	85	53	75
Woody debris, snags and legacy trees	83	40 <sup>a</sup>	42 <sup>b</sup>	90 <sup>a,b</sup>	38
Aquatic and riparian areas	100	40	69	63	38
Threatened and endangered species	83	100 <sup>a</sup>	42 <sup>a</sup>	67	38
Communication and conflict resolution with stakeholders, neighbors and communities	83	60	46	27	75
Exotic species and pests	100 <sup>a</sup>	80 <sup>b</sup>	42	20 <sup>a,b</sup>	63
Set-asides, reserves and representative ecosystems	67	10	46	37	75
Compliance with state, federal and international laws (including state BMPs)	100 <sup>a,b</sup>	50	31 <sup>a</sup>	23 <sup>b</sup>	63
Special cultural sites	67	40	54 <sup>a</sup>	13 <sup>a</sup>	25
Non-timber forest products	67	80	23	13	25
Worker safety	50	30	35	10 <sup>a</sup>	75 <sup>a</sup>
Training	67	40	27	10	38
Fire	17	40	0	37	38
Illegal activities and trespassing	67 <sup>a</sup>	20	19	7 <sup>a</sup>	0
Clearcut use and size	33	0	12	0	38

Operations are grouped by FSC standards region. Table includes only those thematic areas that showed significant differences among regions ( $p < 0.05$ ). Additional pairwise tests identified pairs of regions that were significantly different.

<sup>a</sup> Pair of regions with significant difference.

<sup>b</sup> Pair of regions with significant difference.

there were given conditions requiring them to address Woody Debris, Snags and Legacy Trees. Yet, the Pacific Coast region contains the lowest percentage of companies required to make improvements to the thematic area Communication and Conflict Resolution with Stakeholders, Neighbors and Communities (27%), suggesting that the operations working in the Pacific Coast were, for the most part, practicing a higher degree of communication and conflict resolution than elsewhere in the country, possibly due to state-level requirements put in place after the contentious forest battles of the 1990s (Cashore, 1999).

For many of the thematic areas shown in Table 2, however, differences existed among standards regions that did not have obvious explanations. It is unclear, for example, why such a low percentage of operations in the Lake States was required to address the thematic area Set-asides, Reserves and Representative Ecosystems compared to other regions, or why such a high percentage of operations in the Southeast was required to address Worker Safety. The low number of SmartWood-certified operations in some FSC standards regions – notably, Appalachia with 6 certified operations, the Southeast with 8 operations, and the Lake States with 10 operations – must be kept in mind when comparisons among standards regions are made.

### 6.3. Effects of operation size

Operation size did not affect the number of conditions given to forestry operations nor the number of thematic areas that operations were required to address. There was a significant difference in the average size of SmartWood-certified operations among standards regions: the average operation size was 16,761 ha in Appalachia, 42,105 ha in the Lake States, 23,935 ha in the Northeast, 12,568 ha in the Pacific Coast, and 45,814 ha in the Southeast.

The FSC Principles and Criteria explicitly direct certification assessors to consider the “scale and intensity” of forestry operations when determining whether they are in compliance with the FSC standards (Forest Stewardship Council, 2001). An examination of specific thematic areas revealed that some types of changes were required more frequently by large operations, perhaps due to efforts of auditors to consider scale and intensity. Forestry operations given conditions relating to the thematic areas a) Set-Asides,

Reserves, and Representative Ecosystems, b) Sensitive Sites and High Conservation Value Forests, c) Worker Training and d) Communication and Conflict Resolution with Stakeholders, Neighbors and Communities were significantly larger than those that were given no conditions in those areas.

### 6.4. Relationship between certification and BMPs

Forestry operations located in states with voluntary Forestry Best Management Practices received significantly more conditions than operations in states with mandatory BMPs, and were required to address significantly more thematic areas.

When we examined specific thematic areas, we found that, for approximately one-third of our 34 thematic areas, significant differences existed between operations in states with mandatory BMPs and those with voluntary ones (Table 3). In all but one of the thematic areas with significant differences, operations in states with voluntary BMPs were more likely to receive conditions than those in states with mandatory BMPs. Woody Debris, Snags and Legacy Trees was the one thematic area for which operations in states with mandatory BMPs were more likely to be given conditions than operations in states with voluntary

Table 3

For each thematic area, the percentage of SmartWood-certified operations given at least one condition

Thematic area	Mandatory BMPs (%)	Voluntary BMPs (%)
Sensitive sites and high conservation value forests	56	83
Landscape-level considerations	32	57
Exotic species and pests	24	61
Special cultural sites	18	48
Worker safety	9	46
Communication and conflict resolution with stakeholders, neighbors and communities	26	61
Non-timber forest products	15	41
Compliance with state, federal and international laws (including state BMPs)	24	50
Clearcut use and size	0	17
Training	12	37
Woody debris, snags and legacy trees	85	46

Table includes only those thematic areas for which a significant difference was found between states with mandatory and voluntary BMPs ( $p < 0.05$ ).

BMPs. This finding may be partially explained by the presence of both mandatory BMPs and high natural levels of downed wood in the Pacific Coast region.

Operations in states with voluntary BMPs were given conditions requiring them to address Compliance with State, Federal and International Laws (including state BMPs) more often than those operations located where BMPs are mandatory. A condition related to this thematic area does not necessarily mean that an operation is in non-compliance with laws or BMPs — it may simply require operations to increase awareness of relevant laws among staff members. Nonetheless, this finding implies that the presence of voluntary state BMPs is associated with a lower level of familiarity with state, federal and international regulation, including BMPs.

However, whether BMPs were voluntary or mandatory did not affect the percentage of operations required to address the thematic areas that are central to most state BMPs: Soil and Erosion, Aquatic and Riparian Areas, and Roads and Skid Trails. This finding was counterintuitive, since one would expect that operations in states with voluntary BMPs would fare worse in these thematic areas than those in states where BMPs are mandatory. One possible explanation for this finding is that the presence of voluntary BMPs is enough to ensure that forestry operations do an adequate job addressing water quality and road issues (i.e. issues addressed directly in BMPs), but that forestry norms for other aspects of sustainable forestry in states with voluntary BMPs are different from those with mandatory BMPs. Alternatively, another explanation might involve the wide range of BMP monitoring approaches taken by states; this variation may make mandatory BMPs in some states de facto voluntary. Clearly more research needs to be undertaken so that we can better assess the intersection of these different policy instruments (Gunningham et al., 1998) in addressing environmental impacts.

## 7. Conclusion

The finding that certified operations were required to address an average of 14 different thematic areas as a condition of achieving and maintaining certification — ranging from forest management elements such as

Chemical Use to social elements such as Special Cultural Sites — is a strong indicator that certification helps prompt forestry operations to make important changes in their forest practices. Systems elements such as Management Plan, Monitoring and Inventory were the most commonly addressed thematic areas, followed by ecological elements such as Sensitive Sites and High Conservation Value Forests, and Woody Debris, Snags and Legacy Trees. Future research should now examine the effects of these changes in addressing deterioration of forest ecosystems, structures and associated biodiversity challenges, as well as assessing whether similar impacts occur in tropical forest operations.

The higher degree of change seen in SmartWood-certified operations located in the Southeast and Appalachian FSC standards regions means that the relative benefits of certification to communities and forest ecosystems in those landscapes is especially high.

More research is needed to assess the evidence that the type of change expected of operations during the certification process is related to regionally specific ecological and historical issues. For instance, it appeared that the presence of an issue that was especially relevant to one FSC standards region in particular (such as Woody Debris in the Pacific Coast) figured into the assessors' conditions at a higher frequency in that region than in other regions. Interestingly, operation size had very little effect on the number and type of conditions that operations were given during the certification process.

More work also has to be done on the impacts of forest certification in states with voluntary or mandatory BMPs. While our research found that operations located in states with mandatory (versus voluntary) Forestry Best Management Practices were required to make fewer changes during certification, operations in both types of states were required to make roughly the same number of changes in the water- and road-related areas we examined.

Our empirical analysis of FSC-certified operations provides practical evidence that forest certification does have quantifiable on-the-ground impacts, assuming all conditions are implemented. This research is an improvement over subjective estimates of impacts or “check-mark” approaches. There is considerable room for evaluation of impacts on forest practices for other

programs, such as SFI and PEFC, but this is likely to be more difficult given the conformance/nonconformance approach these systems usually employ and the lack of readily accessible public data for individual forest certification decisions.

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