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What factors influence obtaining forest certification in the U.S. Pacific Northwest?

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Abstract

This study explores the factors that influence obtaining forest certification in the U.S. Pacific Northwest (PNW). A mail survey sent to certified and non-certified forest managing entities (public agencies, forest industry and non-industrial private forest owners) was conducted. The study hypothesized the importance of sixteen biogeographical and socio-economic factors in facilitating the adoption of forest certification. Three of these factors (market pressure, land ownership pattern and water-body abundance) were found to influence the decision to obtain forest certification in the U.S. PNW.

Keywords: Forest certification; Institutional settings; Biogeographical factors; Socio-economic factors; U.S. Pacific Northwest

1. Introduction

Forest certification emerged in the mid-1990s as a market-based incentive to improve forest management (Cashore et al., 2005; Upton and Bass, 1996; Vogt et al., 2000). As a voluntary mechanism, forest certification is considered an addition to the command and control method of governance (Abbott and Snidal, 2003; Cashore and Vertinsky, 2000), the latter normally being enacted by governments through laws, regulations and best available technology prescriptions (Teeter et al., 2003). However, social pressures often pose more requirements than do governments (Aurora and Cason, 1996; Cerin and Karlson, 2002; Elliott, 1996; Kilgore and Blinn, 2004). Some forest managing entities have accepted the public pressure and adopted forest certification, while others have exercised caution in embracing the process (Lawson and Cashore, 2003; Leslie, 2004; Rametsteiner, 2002; Vogel, 2005). An agreed upon view is that companies used to dismiss or manipulate public pressures; later, however, compromise strategies to address public pressure prevailed and companies became more proactive (Cashore et al., 2001; Nasi et al., 1997; Oliver, 1991). Elliott (1996) emphasizes the role of policy and socioeconomic preconditions in the acceptance and development of forest certification. It has been argued that the high costs of forest certification create a limitation that is not easily overcome by the assumed benefits of obtaining the certificate (Fletcher et al., 2002; Forest Stewardship Council, 2002; Hansen, 1997; Murray and Abt, 2001; Rametsteiner and Simula, 2001). In the case of certification, direct and indirect monetary costs accrued may significantly outweigh the monetary benefits gained. In addition, uncertainty surrounding price premiums for certified forest products have made many entities cautious about certification. A few reasons are commonly applied:

1) Price premiums can be negligible or even nonexistent (Sedjo and Swallow, 1999; Wilson et al., 2001).
2) Higher-priced certified products can generally only compete with the non-certified products in higher value wood products sectors (Kozak et al., 2004; Vlosky et al., 2003).
3) The demand for certified products is very limited and producers often have difficulties finding consumers (Anderson and Hansen, 2004).

On the other hand, past research has shown that limiting the reasons of organizational response to material incentives is

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insufficient for obtaining a holistic picture on "corporate greening" (Cashore et al., 2005). Other factors affecting organizational responses include organizational structures, organizational behaviours (corporate culture and changes within), the environments in which companies operate and external pressures (Cashore and Vertinsky, 2000; Oliver, 1991; Vertinsky and Zietsma, 1998).

2. Background

Factors affecting "corporate greening" (in this case, the decision to obtain forest certification) generally include environmental factors, both external and internal to an institution. Earlier research on environmental dependency focused solely on the social environment (Clark and Jennings, 1997; Pfeffer and Salancik, 1978). Current literature on forest certification pays substantial attention to social and economic factors that facilitate organizational responses to pressures, describing them in great detail (see following paragraphs). Biological and geographical factors have received less attention, although they certainly should not be precluded from any discussion on forest certification. Table 1 describes the expected relations of these factors in the form of study hypotheses. The relationships of socio-economic factors are based on a review of the literature (discussed below), while the biogeographical factors have generally not been fully explored and represent newly hypothesized relationships. A factor that was not considered in the study was leadership, although it has become much more significant since the time the research was performed, with many of institutions becoming more proactive through corporate social responsibility practices, for example (Potoski and Prakash, 2005).

2.1. Socio-economic factors

Different stakeholder groups have been identified as pressuring institutions, including environmental activists (Elliott and Schlaepfer, 2001; Sasser, 2003; Stafford and Hartman, 1996), company shareholders (including institutional investors) (Nasi et al., 1997; Vertinsky and Zietsma, 1998), associations of peers/companies of a similar scale (Vertinsky and Zietsma, 1998), supply chain customers (direct wholesalers or dealers) (Anderson and Hansen, 2004; Auld et al., 2003) and final consumers (Marshall et al., 2005; Ozanne and Vlosky, 2003; Vlosky and Ozanne, 1997). Large institutions and their practices attract greater attention from the public, and therefore, are more prone to experience public pressure (Cashore et al., 2005; Cashore et al., 2001; Vertinsky and Zietsma, 1998; Vidal et al., 2005). However, if an institution has been proactive from the onset of such pressures, this can serve to lessen the response that is required (Aurora and Cason, 1996; Cashore et al., 2001; Potoski and Prakash, 2004; Prakash, 2001; Vertinsky and Zietsma, 1998).

Besides social pressure drivers, certain institutional factors characteristic to an entity can also influence the response strategies to pressures. For instance, land ownership patterns have been found to be a determining influence on response strategies (Cashore et al., 2005, 2001; Vlosky, 2000; Vlosky and Granskog, 2003). Companies with an export orientation tend to experience higher degrees of pressure based on their customers' preferences for product specifications (Potoski and Prakash, 2004; Prakash, 2001, 2002) or their exposure to environmental concerns (Cashore et al., 2003; Cashore and Vertinsky, 2000). Other factors related to business, such as existing infrastructure (Aurora and Cason, 1996; Greening and Gray, 1994; Sasser, 2003) and product diversity (Kozak et al., 2004; Wilson et al., 2001), can also lessen the necessity to react to external pressures.

Applying these findings to the case of forest managing entities making decisions to obtain forest certification means that the key socio-economic factors influencing decisions to pursue certification include export markets, company sizes and structures, social pressures and ownership of forestlands. In addition to these factors, market pressures and degrees of business establishment through infrastructure can also be considered relevant.

2.2. Biogeographical factors

In addition to the commonly cited socio-economic factors, important biological and geographical factors that can affect decisions to obtain forest certification were examined in the study. The factors were selected through a review of regulatory requirements and the relevant literature. While some were chosen because of their relevance to the requirements of certification standards (e.g., water and soil protection), others were chosen because they require additional attention when selecting forest management regimes (e.g., disturbance types, ecosystem diversity or protected species or ecosystems). Throughout this paper, Section WAC 222 of the Forest Practices Rules (Washington State Department of Natural Resources, 2001) and the Forest Practices Administrative Rules and Forest Practices Act (Oregon Department of Forestry, 2002) are cited as the regulatory requirements in the Pacific Northwest (PNW) states of Washington and Oregon, respectively.

2.2.1. Ecosystem diversity

The presence of several different ecosystems within a management unit is hypothesized to make the adoption of forest certification more difficult. The basis for this hypothesis lies in the fact that different ecosystems require different management strategies. Therefore, an entity has to adapt its forest practices to provide for flexibility in selecting a management regime, and that requires a greater resource input. Ecosystem classifications (Franklin and Dyrness, 1988; Lyons and Merilees, 1995) based on the most common tree species found in both Washington and Oregon illustrate the variety of ecosystem types in the region.

2.2.2. Large-scale disturbance

All major forest certification schemes require a forest management plan with long-term projections for forest management. Small-scale disturbances call for a compatible management regime, while large stand-replacing disturbances may require several management scenarios. The latter need to reflect the risk and uncertainty of disturbance as the potential timber harvest rate may vary dramatically based on type and scale of the disturbance (Franklin and Dyrness, 1988; USDA Forest Service, 1990). Uncertainties surrounding resource availability

Table 1
Factors influencing obtaining forest certification, corresponding variables and their use in the model (Likert scales were used for variables with interval scale)

Research hypotheses	Variable	Variable characteristics	Used in the model?
Socio-economic factors			
Shareholder-owned companies are more likely to pursue forest certification (Stafford and Hartman, 1996)	Ownership structure	Dummy (public vs. shareholder vs. private)	Very few cases in "shareholder" ownership category — excluded
Entities operating on public forestland are more susceptible to pressures to obtain certification than private forestland owners (Cashore et al., 2001)	Private land	Dummy (yes, no)	Yes
Larger entities are more likely to obtain certification than smaller entities (Sasser, 2003)	Size	Continuous (ha)	Yes
Entities with orientation to export markets are more likely to obtain certification than entities producing for domestic market solely (Cashore and Vertinsky, 2000).	Export proportion	Continuous (percent of volume)	Yes
The greater the product diversity produced by an entity, the easier it is for it to adopt certification in order to maintain market share (Wilson et al., 2001).	Product diversity	Continuous (number of products)	Did not hold the linearity of the logit assumption — excluded
The better the existing infrastructure of an entity, the easier it is for an entity to obtain certification (Aurora and Cason, 1996)	Accessibility (road network)	Continuous (km of roads built)	Yes
Entities that have previously had experience with social pressure are more likely to obtain certification (Cashore et al., 2005).	Boycotting	Dummy (yes, no)	Very few cases — excluded
The higher the environmental requirements of associations the entity is a member of, the more likely it is to pursue certification (Vertinsky and Zietsma, 1998).	Association pressure	Continuous (interval scale)	Did not hold the linearity of the logit assumption — excluded
The greater market pressure that wholesalers, retailers and dealers exercise, the more likely the entity is to requests to pursue forest certification (Auld et al., 2003).	Market pressure (wholesalers, etc.)	Continuous (percent of customers)	Yes
Biogeographical factors			
The greater the ecosystem diversity where the forest operations take place, the more difficult it is for an entity to obtain certification	Ecosystem variety	Continuous (number of ecosystem types)	Impossible to assess from survey responses
Coastal ecosystems are considered more environmentally valuable, and entities operating in such areas are less likely to obtain certification.	Coastal	Dummy (yes, no)	Yes
The greater the slope steepness of the terrain where the forest operations take place, the more difficult it is for an entity to obtain certification.	Steepness	Continuous (typical grade)	Yes
The greater the scale of disturbance common in the area of forest operations, the more difficult it is for an entity to obtain certification.	Prone to large-scale disturbance	Continuous (interval scale)	Did not hold the linearity of the logit assumption — excluded
The presence of endangered or threatened species in the area of forest operations makes it more difficult for an entity to obtain certification.	Red-listed species	Continuous (interval scale)	Did not hold the linearity of the logit assumption — excluded
The greater area of forest operations that is covered by surface water, the more difficult it is for an entity to obtain certification.	Water body abundance	Continuous (percent area cover)	Yes
The more remote forest operations are from large settlements (with population greater than 20,000 people), the more likely it is to obtain certification	Remoteness (from settlements larger>20,000)	Continuous (km)	Yes

in areas subject to large-scale disturbances are hypothesized to be a constraint with respect to decisions to undergo certification.

2.2.3. Threatened and endangered species

Threatened and endangered species and requirements for the management of their habitats are addressed in Washington WAC 222-10-040 through 222-10-042, as well as WAC 222-16-080 through 222-16-105. The Oregon Forest Practices Act devotes Division 665 (Specified Resource Site Protection Rules), Sections 629-665-000 through 629-665-240 to explaining the goals of species and habitat protection requirements and exceptions. The necessity to adapt forest management to species-at-risk requirements is hypothesized to decrease the commitment of a forest managing entity to pursue certification.

2.2.4. Coastal ecosystems and remoteness

In the U.S. PNW, forestry practices in coastal ecosystems are subject to particular scrutiny by the public, as they contain forests highly valued by an increasingly environmentally-concerned public (WWF, N.d.). In contrast, the remoteness of an area from large settlements tends to result in reduced public criticism of forestry issues, as the objectives for forest use differ between urban and rural areas (Bass et al., 2001). In the U.S. PNW, the remoteness of forest operations has been assessed in terms of the distance from a settlement of 20,000 people. This threshold was based on Oregon and Washington definitions of rural areas (Chimoskey and Norris, 1999; Oregon Rural Health Association, N.d.). The remoteness of forest operations decreases public pressure and is, therefore, hypothesized to ease the decisions to obtain certification. Managing a coastal operation (as an operation with higher public constraints) decreases the ability to allocate operational resources to additional requirements. It is hypothesized that a coastal operation is less likely to undergo certification due to limits on available resources.

2.2.5. Water-body abundance

Specific protection established for water bodies and their adjacent riparian areas imposes constraints on forest management for timber. The more abundant water bodies are in a certain forest management area, the greater are the complexities of planning and operations. The Oregon Forest Practices Code addresses water protection under Divisions 635–655, and 660. Riparian zones and their management are set separately for each type and category of water body. In Washington, water bodies are classified in WAC 222-16-030 and WAC 222-22, 222-23. Riparian zones and their management are set separately for Western and Eastern Washington, and for each of five zone classes within a water class. Compliance with the riparian management requirements is hypothesized to limit the ability of forest managing entities to pursue forest certification.

2.2.6. Terrain steepness

Steep/unstable slopes are designated as risk areas in both Washington and Oregon. WAC 222-16-050 prescribes specific stricter forest practices for certain terrain classes. In Oregon, 629-600-100 (28) defines slopes steeper than 65% as high-risk sites. High-risk areas and high-risk sites are determined by the State Forester and require special approval of any proposed management actions. As steep terrain introduces additional difficulties to forest planning and management, it is hypothesized that it constrains decisions to obtain certification.

3. Methodology

3.1. Scope and objectives

This study aimed to reveal the attributes of forest managing entities that influence decisions regarding the adoption of forest certification. This project hypothesizes that institutional responses to pressure depend on both socio-economic and biogeographical factors. The environmental aspects discussed above (types of ecosystem where entities operate, terrain steepness, disturbance types, abundance of surface water, threatened and endangered species and remoteness) were assumed to add constraints to operations and, therefore, influence the behaviour of forest managing entities with respect to obtaining forest certification.

Given the lack of understanding of the influence of biogeographical factors in the adoption of certification, the relevance of several of these biogeographical factors was hypothesized along with the relevant socio-economic factors identified from past research (Table 1).

The geographic scope of this study covered forest landowner entities in the U.S. PNW, specifically the states of Oregon and Washington. The study assessed the responses of the forest industry, governmental organizations managing forestlands and non-industrial private forest owners. These included the U.S. Forest Service (USFS), the Washington Department of Natural Resources (DNR), the Oregon Department of Forestry (ODF), the U.S. Bureau of Land Management (BLM), tribal lands and small non-industrial owners in the PNW. All major forest certification standards in the region were explored: the American Tree Farm System, Sustainable Forestry Initiative and Forest Stewardship Council. Both certified and non-certified entities were included in the study.

3.2. Data collection

Data were collected through a mailed self-administered survey to a stratified sample of forest managing entities in Washington and Oregon. The three sample strata were forest industry, public agencies and non-industrial private forest land owners. A three-point contact system was used to mail out the survey, which constituted a modification of the Total Design Method (Dillman, 2000). The period between the three survey mailings was approximately 1.5 months, which differs from Dillman's (2000) recommendations of two weeks. The survey was conducted in May–August 2004.

The survey package contained a cover letter, the survey and a stamped return envelope, and included structured, semi-structured and non-structured questions, as well as the opportunity to provide comments (only interval scales, binary scales and continuous data were considered in this analysis). The survey questions requested information on internal organizational structures and the local physical, social, market and legal environments within which they operate (Tikina et al., in press). For the companies and agencies, the surveys were directed to regional offices to the employees responsible for either environmental affairs (first choice) or silviculture (second choice). For non-industrial private forest land owners, a random sample of 40% of the Washington Farm Forestry Association (WFFA) and Oregon Small Woodlands Association (OSWA) was taken.

Of the 1248 surveys mailed out, 381 were returned and 353 surveys were usable. This provided a response rate of 28.3%, which is considered acceptable for survey research (Babbie, 2001). Out of 101 surveys sent to the industry, 35 were returned, while 27 were usable (response rate of 26.7%). Usable surveys from the public agencies included six responses from ODF, two from DNR, five from the USFS, five from the BLM, and six from aboriginal (tribal) organizations. The response rates of the public entities were 32% (8 surveys) for state agencies and 26% (16 surveys) for federal agencies, respectively. The NIPF response rate was 28%. Non-response bias tests were performed using two-tailed *t*-tests ($\alpha = 0.05$) on the data provided by early versus later respondents; no indication of non-response bias was observed in this study.

For the forest industry, 63% of respondents were certified. Within the public stratum, only 13% were certified, while the other 87% were not. Almost half of NIPF respondents (52%) were certified by one scheme or another. Overall, 49% percent of responses came from certified entities.

3.3. Statistical analysis

Identifying relationships between the adoption of certification schemes and the factors of interest in this study was performed using logistic regression procedures (Bergerud, 1996; Hutchinson and Sofroniou, 1999; Tabachnik and Fidell, 2001). The probability of being certified by a scheme was used as a response variable. A probability greater than the cutoff point of 0.5 indicated that an entity was likely to be certified.

Standard logistic regression was conducted using SAS PROC Logistic to assess the probability of being certified, $P(X)$, in relation to the bio-geographical and socio-economic institutional factors described above. The variables used for the model development are listed in Table 1. A few continuous variables (Hutchinson and Sofroniou, 1999) were measured using interval (Likert) scales. Three binary variables and one categorical variable were introduced as dummy variables. The details of variables, their characteristics and their use in the further model development are also presented in Table 1.

The dataset was first screened for outliers through plots of estimated probability versus one step differences in the Pearson chi-square statistics. The three cases with the greatest difference (8-10 steps) were considered outliers and excluded from the analysis. Multicollinearity was assessed through Pearson correlations between the variables. Multicollinearity did not present a problem in the analysis as the correlations ranged from low to medium.

The linearity of the logit assumption was then tested with the Box-Tidwell approach (Tabachnik and Fidell, 2001), and the log transformations of each variable were added to the full hierarchical model. The following variables violated the linearity of the logit assumption: product diversity, natural disturbance, influence of endangered species and association pressure. As such, they did not enter the model. Ecosystem diversity could not be properly assessed from the survey responses, and was also excluded from the model development. There were too few cases of publicly owned companies, and the introduction of the "Boycotting" variable did not allow for the MLE (Maximum Likelihood Estimation) solution. Thus, both of these variables (boycotting and company ownership structure) were dropped from the model development. These decisions are also described in Table 1.

All variables included were left in their original forms (none were transformed) in order to facilitate the interpretation of the results. Although the variables had slight to moderate departures from normality, normality is not a necessary requirement for logistic regression analysis (Tabachnik and Fidell, 2001). In the analysis, 152 missing values in explanatory and response variables were detected, leaving 229 valid cases to use for the model development.

4. Results and discussion

Several models were attempted, including the full hierarchical model with potential interaction variables, the latter incorporating the products of two independent variables. However, inclusion of the interaction variables led to the absence of an MLE solution and the interaction terms were not included into the final model. The MLE solution was derived in five iterations (Table 2).

All of the tests employed provided evidence of relatively good model fit. The null hypothesis of all $\beta = 0$ was rejected with a significant Likelihood Ratio = 86.67 and Wald Criterion = 35.64. The Hosmer–Lemeshow test was used to assess the goodness-of-fit. The fitted model ($N = 229$, $\chi^2 = 4.8503$) produced $p = 0.7734$, and the non-significant chi-square showed a reasonable fit (Tabachnik and Fidell, 2001). Other diagnostics employed were pseudo R^2 tests (Cox and Snell R^2 = 0.3151 and max-rescaled R^2 = 0.4211). The pseudo R^2 values were relatively high for logistic regression, where, unlike linear models, R^2 can never approach the maximum of 1. The Nagelkerke R^2, which corrects the Cox and Snell measure so that the value of 1 can be achieved, reached 0.5599 for this model. The model classified in 65.5% cases correctly, which is 15.5% greater than by chance alone. The misclassification consisted of 45.3% of false negatives (omission errors) and 33.0% of false positives (commission errors).

Table 2
Variables used in logistic regression analysis

Variable	Estimate (β)	S.E.	Wald	Significance	Odds ratio
Biogeographical factors					
Intercept	−0.8393**	0.4117	4.1557	0.0415	
Coastal	0.4296	0.3445	1.5554	0.2123	1.537
Steepness	−0.00717	0.0128	0.3118	0.5766	0.993
Water body abundance (X3)	0.0729*	0.0394	3.4195	0.0644	1.076
Remoteness	0.00561	0.00499	1.2676	0.2602	1.006
Socio-economic factors					
Private land (X1)	−3.3318**	1.0255	10.5565	0.0012	0.036
Size	−1.77E-6	1.951E-6	0.8250	0.3637	1.000
Export proportion	0.3898	0.4228	0.8498	0.3566	1.477
Accessibility (road network)	0.00871	0.00819	1.1306	0.2877	1.009
Market pressure (X2)	0.0489**	0.00936	27.3271	<.0001	1.050

** — statistically significant at $\alpha = 0.05$ level or better.
* — statistically significant at $\alpha = 0.10$ level.

Of the 10 variables used for the analysis, three variables contributed significantly to the model. They were land ownership, water body abundance and market pressure. The intercept was also significant and was included in the model to improve the fit of the logistic regression (Table 2).

The final form of the logistic regression model was:

$$\Pr(\text{cert}) = \frac{e^{-0.8393-3.3318*X1+0.0489*X2+0.0729*X3}}{1+e^{-0.8393-3.3318*X1+0.0489*X2+0.0729*X3}} \tag{1}$$

The dependent variable shows the probability of a forest managing entity in the U.S. PNW being certified. Three variables (water-body abundance, market pressure and private vs. public land) were the only ones that were significant in determining whether or not an entity is certified.

The interpretation of the odds ratios provided some interesting insights and unexpected results. It was found that entities operating on public land have 96.4% lower odds of being certified than those managing private land. In terms of land ownership (private vs. public land, i.e. federal, state and tribal land in Washington and Oregon), prior research suggested a positive relation (entities on public lands are more prone to "go green" with adopting certification) (Cashore et al., 2001). However, a very significant negative relation was discovered. This latter finding supports earlier work (Vlosky, 2000), but may no longer be applicable as the data were obtained from public entities before the commitment of Washington State to obtain certification for its lands (Corrao, 2005).

For every additional percent in water-body abundance, the odds of being certified increased by 7.6%. This result should be treated with caution, as the water-body abundance was used as a proxy to indicate extent of riparian area on the land holding and the relationship may appear significant through a "transfer" effect from the regulatory requirements. The water protection requirements of both Washington and Oregon, as well as federal laws and regulations in these states, are very detailed and demanding. Vertinsky and Zietsma (1998) found that the likelihood of spending additional effort on obtaining certification is inversely proportional to the difficulty of coping with regulatory requirements for environmentally-sensitive areas, based on the amount of the financial and other resources available to an entity. Prior to the model-fitting, the relationship between water-body abundance and being certified was expected to be negative (i.e. the more surface water-bodies a holding has on the land, the more difficult it is for the entity to become certified). The model showed, however, that the relation is positive; with a one-unit percent increase in water-body abundance, the probability of being certified increased by 7.6%. An explanation may be that holdings having a greater impact on their operations from riparian requirements try to achieve recognition of their efforts through certification.

For each additional percent of customers (of the total number of customers) requesting certified goods, the odds of being certified increased by 5.0%. This finding confirms the results of prior research (Auld et al., 2003; Vidal et al., 2005) regarding the influence of this socio-economic factor. On the other hand, the survey did not distinguish between categories of customers (e.g., brokers, retailers, end users), and it is impossible to conclude that the finding applies to all categories to the same degree. All certified entities were analyzed together without separating the certification standards, and this may have weakened the results.

Although a positive relationship was anticipated between the percentage of exports in the timber sales of a holding and the probability of being certified based on prior research (Cashore and Vertinsky, 2000), it was not significant. This finding corresponds with the recent work of Cashore et al. (2005), who also hypothesized that entities with large export sale proportion would be more inclined to pursue certification, but did not find statistical evidence to support this assertion. Other socio-economic factors which have been previously hypothesised to be influential on the adoption of certification, such as the effects of the holding size (Mathur and Mathur, 2000; Sasser, 2003; Vertinsky and Zietsma, 1998) and the development of infrastructure (Aurora and Cason, 1996), were included in the model, but were not significant.

Among the biogeographical variables, it appears that only water-body abundance had a significant influence on the probability of being certified. The results pertaining to the non-significant factors were also interesting. The difficulty of operations on steep terrain may preclude allocation of resources toward certification, but the variable appears non-significant, even though the relationship is negative as hypothesized. The remoteness of operations from larger settlements was hypothesized to decrease public pressure and minimize the incentives to obtain certification, but the empirical findings did not support the hypothesis. The opposite was expected of the coastal holdings (the coastal ecosystems are considered to be more unique and entities operating in these areas may be subject to greater amounts of pressure), but there was no evidence to support this hypothesis either. The latter two hypotheses were likely to be incorrect as forest managing entities may use forest certification as a means to repel public scrutiny in coastal operations and may be more prone to pursue certification. On the other hand, the remoteness of forest operations often leads to reduced or no public criticism and may negate the need to adopt certification. The same applies to the hypothesis on threatened and endangered species, which stated that the limited amount of resources would not allow an entity to follow flexible forest management in the presence of threatened and endangered species. However, the fact that an entity follows stringent regulatory requirements on these species and produces an example of responsible forest management may stimulate their decisions to obtain certification as a means of garnering public recognition for their efforts.

5. Conclusion

The study examined factors that influence obtaining forest certification in the U.S. states of Washington and Oregon. It explored the importance of seven biogeographical and nine socio-economic factors in facilitating the adoption of forest certification. Based on a logistic regression model, three factors were discovered to influence the decisions to obtain forest certification in the PNW: market pressure, land ownership pattern and water-body abundance. Market pressure was confirmed to affect greater adoption of certification. While entities operating on public land ("land ownership pattern" variable) were originally hypothesized to be more prone to pursue certification, the study supported the contrary view. Another finding that contradicted the original hypothesis pertained to water-body abundance; it had been hypothesized that entities on territory with a larger percent of area covered by water-bodies were less prone to adopt certification, but the study results showed the contrary. That said, the effect of the water-body abundance should be treated with some caution, given its possible correlation with socio-economic phenomena (e.g., regulatory requirements).

Since other biogeographical factors besides the water-body abundance (terrain steepness, remoteness or location of operations) either did not have or may have lost their significance in the presence of overriding socio-economic factors (including policy decisions, such as a decision to certify state lands in Washington), the results here present some doubt regarding the impact of biogeographical factors in influencing adoption of forest certification. Although the logistic regression showed the importance of only one biogeographical factor, the study also confirmed the relevance of socio-economic factors in decisions for certification in the U.S. PNW. However, the data characteristics do not enable extrapolation of the results beyond Washington and Oregon and it would be interesting to compare the results with similar studies conducted in other U.S. states (e.g., in the Southeast with its different forestry regulatory environment and smaller proportion of public forest lands).

To summarize, a surprisingly small number of factors were found important with respect to decisions to adopt certification in Washington and Oregon. However, it should be noted that the exclusion some variables could be attributed to the still limited number of certified entities, the short history of forest certification and the lack of perfect proxies that could be measured to directly quantify the effects on adoption of certification.

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