Research article

Understanding perceptions of stakeholder groups about Forestry Best Management Practices in Georgia

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ABSTRACT

Forestry Best Management Practices (BMPs) are critical in ensuring sustainable forest management in the United States because of their effectiveness in protecting water quality, reducing soil erosion, maintaining riparian habitat, and sustaining site productivity. The success of forestry BMPs depends heavily on coordination among primary stakeholder groups. It is important to understand perceptions of such groups for a successful forest policy formulation. We used the SWOT-AHP (Strengths, Weaknesses, Opportunities, and Threats analysis with the Analytical Hierarchy Process) framework to assess perceptions of three stakeholder groups (loggers, landowners, agency foresters) about forestry BMPs in Georgia, the largest roundwood producing state in the United States. The agency and logger stakeholder groups gave the highest priority to improved reputation under the strength category, whereas the landowner stakeholder group perceived sustainable forestry as the highest priority under the same category. Lack of landowner education was the highest priority under the weakness category for landowner and agency stakeholder groups, whereas the logger stakeholder group selected lack of trained personnel as the highest priority under the same category. Agency and landowner stakeholder groups gave the highest priority to training and education while loggers indicated maintenance of forest-based environmental benefits as their highest priority under the opportunity category. Finally, landowners and agency stakeholder groups perceived more regulations and restrictions as most significant in the threat category whereas the logger stakeholder group was most concerned about the insufficient accounting of cost sharing under the same category. Overall, selected stakeholder groups recognize the importance of forestry BMPs and had positive perceptions about them. A collaborative approach based on continuous feedback can streamline expectations of stakeholder groups about forestry BMPs in Georgia and several other states that are interested in maintaining high compliance rate of forestry BMPs for ensuring sustainable forest management.

1. Introduction

Silvicultural activities impact 2.4% of the total length of rivers and streams in the United States (U.S. Environmental Protection Agency, 2000). Silviculture is listed as a source of impairment to rivers and streams in 26 states, including nine in which it is considered a major source of impairment. Therefore, several states have developed and adopted forestry Best Forestry Practices (BMPs) over time to reduce the impact of silvicultural activities on water quality in response to amendments to the Federal Water Pollution Control Act of 1972 and the Clean Water Act Amendments of 1977 (Cubbage, 2004).

The effectiveness of forestry BMPs as a tool for water quality protection is well established. Aust and Blinn (2004) reviewed several studies assessing the impacts of forestry BMPs for timber harvesting and site preparation on site productivity and water quality in the 12 physiological regions of the eastern United States. They reported that existing forestry BMPs help improve water quality but can be refined further to reflect site-specific conditions. Grace (2005) reviewed several studies and found that BMPs can minimize the effects of non-point source pollution caused by silvicultural activities in the southern United States. Anderson and Lockaby (2011) reviewed 17 studies from different physiographic regions in the southern region of the United States (8, 6, and 3 from

the Coastal Plain, Piedmont, and Mountains, respectively) and concluded that forestry BMPs improve/maintain water quality, with streamside management zones as the most effective measure. Cristan et al. (2016) reviewed a total of 81 studies (30, 31, and 20 studies in the southern, western, and northern regions of the United States, respectively) and found that correctly implemented forestry BMPs protect water quality nationwide and help states in achieving their water quality goals. Apart from studies which focus on the effectiveness of forestry BMPs in reducing non-point source pollution, Ice et al. (2010) reported that the compliance rate of forestry BMPs has increased significantly nationwide since 1972 and currently stands at about 89% at the national level.

The continued success of BMPs in minimizing non-point source water pollution has made them an important tool for ensuring forest stewardship. The United States Environmental Protection Agency recently reaffirmed its approval of forestry BMPs to address water quality problems related to forest roads (U.S. Environmental Protection Agency, 2016). Similarly, forest certification programs like the Sustainable Forestry Initiative (SFI) rely on forestry BMPs to set their certification standards. For example, as a part of the SFI's Fiber Sourcing Standard, certified forest products mills must include contractual obligations for loggers to follow forestry BMPs and mills must conduct periodic checks on harvest sites from where they sourced wood (Sustainable Forestry Initiative, 2015).

As effective as BMPs are in sustainable forest management, to answer the question of whether BMPs are working as intended, and if they are doing enough to mitigate the impacts of human activity on the environment, the social and economic perspectives should not be ignored (Jackson, 2014). While Phillips and Blinn (2007, 2004) have expressed a need to standardize the guidelines of compliance monitoring programs to make them comparable across regions, Jackson (2014) points out that the human dimensions of BMPs make regional variations unavoidable. For example, as discussed in Carter et al. (2015) forestry BMPs in the Southeastern United States developed in a non-regulatory environment with heavy input from industry and other stakeholders because of the region's market structure and general aversion to governmental rules and regulations. This contrasts with the Pacific Northwest whose forestry BMP structure has evolved into one that is regulatory with significantly more government involvement.

Stakeholders are pivotal to the implementation, development, and assessment of BMPs. Only a handful of studies have focused on economic (Cubbage, 2004; Shaffer et al., 1998) and welfare (Sun, 2006) dimensions of forestry BMPs. Studies which focus on social dimensions of forestry BMPs (Knoot and Rickenbach, 2011; McGill et al., 2006; Munsell et al., 2006) primarily examine the attitudes of forest landowners and the impact of policy instruments on adoption of sustainable forest management practices, including BMPs by landowners (Maker et al., 2014; Provencher et al., 2007; Vanbrakle et al., 2013). To the best of our knowledge, only Husak et al. (2004) has compared the perceptions of three stakeholder groups (family forest landowners, forestry consultants, and industry) about perceived values of benefits derived from forestry BMPs in Mississippi.

Different stakeholder groups, including forest landowners, are involved in the forestry supply chain, and each of them faces a unique set of constraints in the context of forestry BMPs. This gives us reason to believe that various stakeholder groups would have different perspectives about forestry BMPs. A better understanding of perceptions of stakeholder groups about forestry BMPs may inform policymakers about possible conflicts among stakeholder groups. This information can be utilized for formulating better policies for improving effectiveness of forestry BMPs as a tool of sustainable forest management in the United States. Coupled with the physical studies on the effectiveness of forestry BMPs, the

perspective gained from our research on human dimensions of forestry BMPs will provide a complete understanding of the challenges related to forestry BMPs in the United States and hopefully, will feed into the future forest policies at regional and national levels.

2. SWOT-AHP framework

SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is a planning tool used to identify internal strengths and weaknesses and external opportunities and threats related to an industry, firm, project, product, or individual (Ghazinoory et al., 2011). However, SWOT analysis does not provide a comparison of the relative priority of identified factors under different categories. The AHP (Analytic Hierarchy Process) is a multi-criteria decision-making technique that measures the relative priority of one factor over other factors through pairwise comparisons (Saaty and Vargas, 2012). The data obtained through pairwise comparisons are analyzed by following Eigenvalue technique to determine priority values of factors as explained in Dwivedi and Alavalapati (2009). When applied to the factors identified as a part of SWOT analysis, the AHP enhances the information through a measured comparison of the importance across factors. This provides deep insight into the potential agreements and conflicts among stakeholder groups and can be of use with policies dealing with sustainable management of natural resources. Another advantage of utilizing the SWOT-AHP framework is that a large number of participants are not needed, as inputs provided by a few experienced respondents are sufficient to reflect perceptions of a stakeholder group (Shrestha et al., 2004). The use of SWOT-AHP has become popular in the sustainable management of natural resources because of its simplicity in identifying points of agreements and disagreements across stakeholder groups for conflict resolution (Dwivedi et al., 2016; Kukrety et al., 2013; Kurttila et al., 2000; Ramirez et al., 2012).

3. Methods

We used the SWOT-AHP framework to assess the perceptions of three forestry stakeholder groups— loggers, landowners, agency foresters (Georgia Forestry Commission,[1] GFC)— about forestry BMPs in Georgia, the largest roundwood producing state in the United States (Oswalt et al., 2014). Forestry BMPs in Georgia were developed in 1981 and updated several times thereafter (Georgia Forestry Commission, 2009). Currently, forestry BMPs are non-regulatory in Georgia because silvicultural activities are exempt from the permitting processes provided forestry BMPs are followed. Compliance is monitored by the GFC and regulatory agencies only get involve when improper implemented BMPs are not sufficiently mitigated by a responsible party. Survey results of the GFC suggest that, on an average, the forestry BMP implementation rate at the state level has been between 90% and 95% since 2004 (Georgia Forestry Commission, 2015).

We conducted two focus group discussions (Washington, GA and Forsyth, GA) with loggers operating in Georgia to determine suitable factors under each SWOT category. At both focus group discussions, the participants were split into one of two groups: large (35 or more loads delivered per week) and small (less than 35 loads delivered per week). The cut-off of 35 loads delivered per week was decided by participants of focus group discussions only. The focus groups were conducted as open-ended discussions where participants were asked to share their thoughts on internal factors (strengths and

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[1] The state agency responsible for the management of forestry resources in Georgia.

Table 1
SWOT factors identified through focus group discussions.

Internal	Strengths	Weaknesses
	1 Promotes sustainable forestry	1 Lack of landowner education
	2 Maintains/increases access to markets	2 No economic incentives
	3 Promotes a culture of safety	3 Lack of trained personnel
	4 Improves reputation of logging community	4 Inconsistent interpretation of BMP guidelines
External	Opportunities	Threats
	1 Improved training and education opportunities	1 More regulations and restrictions
	2 Better interagency coordination	2 Insufficient accounting of cost sharing
	3 Maintenance of forest-based environmental benefits	3 Increasing urban populations

weaknesses) and external factors (opportunities and threats) that influence their perceptions of forestry BMPs in Georgia. At the end, both groups presented their responses for further discussions. We evaluated responses from the focus group discussions and identified factors that were consistently mentioned within each SWOT category. We also consulted existing literature (Ellefson et al., 2001; Germain et al., 2014; Husak et al., 2004) and other field practitioners before finalizing the factors within each SWOT category. We identified a total of four strengths, four weaknesses, three opportunities, and three threats (Table 1).

We developed a questionnaire to gauge the level of importance of each factor relative to others within the same SWOT category for each stakeholder group. This questionnaire included detailed instructions and short explanations of the identified factors to provide the same context to all respondents (Appendix 1). For example, we asked participants to compare the factors of "promotes sustainable forestry" and "maintains/increases access to markets" within the strengths category (Fig. 1). The participants marked the box that indicated the degree to which they believed one factor was more important than the other, or if they were equal. The questionnaire asked respondents to indicate their preference of one factor over the other for each pairwise comparison using the scale of Equal, Somewhat More Important, More Important, or Much More Important. We assigned weighted numerical values

(Equal = 1, Somewhat More Important = 3, More Important = 5, and Much More Important = 7) to the responses for analysis (Dwivedi and Alavalapati, 2009).

For the first survey, we collected responses of 25 loggers and 10 landowners at five events throughout Georgia (Table 2). For the agency stakeholder group, we collected seven responses via e-mail. We aggregated individual responses from the first round of surveys by stakeholder group using the geometric mean method and then used standard AHP procedure to calculate a priority value for each factor present within each SWOT category for each stakeholder group (Saaty and Vargas, 2012). Next, we developed three more questionnaires, one for each stakeholder group, using the highest priority factor from each SWOT category. The objective of the second survey was to determine the relative priority of SWOT categories themselves with respect to each other. For the second round of surveys, we received seven valid responses from loggers and 10 from landowner stakeholder groups at two separate events and collected seven valid responses via email for the agency stakeholder group (Table 3). Again, we used geometric mean to aggregate individual responses followed by standard AHP procedure to calculate priority values of the top factors from each SWOT category for each stakeholder group. The priority values from the first round of surveys were multiplied by the priority values of SWOT categories from the second round of surveys to obtain an overall priority ranking of

Fig. 1. An example of pairwise comparison of the strength category from the developed questionnaire.

Table 2
Survey locations and response counts for prioritizing factors under SWOT categories. SWPA: Southeastern Wood Producers Association.

Stakeholder Group	Event	Location	Date	Valid Responses
Logger	SWPA Chapter Meeting	Claxton, GA	Jan 17, 2017	11
	SWPA Chapter Meeting	Jesup, GA	Jan 31, 2017	10
	SWPA Chapter Meeting	Calhoun, GA	Feb 13, 2017	4
Landowners	Madison-Morgan Conservancy Workshop	Madison, GA	Jan 26, 2017	4
	Landowner Education Workshop	Albany, GA	Apr 11, 2017	6
Agency	Online (emails)		Mar 10–16, 2017	7

Table 3
Survey locations and response counts for prioritizing SWOT categories. MTH: Georgia Master Timber Harvest Program. USDA NRCS: United States Department of Agriculture Natural Resources Conservation Service.

Stakeholder Group	Event	Location	Date	Valid Responses
Logger	MTH Workshop	Forsyth, GA	Feb 22, 2017	7
Landowner	Forest Landowner Meeting, USDA NRCS	Waverly, GA	Apr 25, 2017	10
Agency	Online (emails)		Mar 21—28, 2017	7

factors. This provided a perspective on the relative priorities of all SWOT factors for each stakeholder group.

4. Results

For the logger stakeholder group, reputation explained 32% of perception within the strength category, followed by safety at 25%, access to markets at about 22%, and sustainable forestry at 21% (Fig. 2). Historically, environmental groups have blamed the logging industry for not doing its part in ensuring the sustainability of forestry resources (Bartley, 2003). However, successful adoption of forestry BMPs has helped the logging community to demonstrate their commitment to sustainable forestry which in turn has increased the overall reputation of the industry. Shaffer and Meade (1997) mentioned that following BMPs helps in safety and increasing productivity through better planning and reducing machine downtime. This could be a reason behind the high priority given to the factor safety. While BMPs are non-regulatory in Georgia, many large mills in the state are certified to SFI's Sustainable Fiber Sourcing Standard, and thus, require BMP compliance as part of their timber purchase contracts. This could explain the high priority value given to access to markets.

Lack of trained personnel explained about 28% of loggers' perception in the weakness category with no economic incentives, landowner education, and inconsistent interpretation explaining 26%, 24%, and 22%, respectively. The factors of forest-based benefits and improved training and education both explained about 36% of the perception of the logger stakeholder group about opportunities followed by interagency coordination explaining the remaining 22%. The factor accounting of cost sharing explained 51% of loggers' perception of threats, with 25% explained by regulations and restrictions and 24% by urban population. Costs related to forestry BMPs have gone up in recent years (Cubbage, 2004). Loggers have to absorb the majority of this cost as landowners are typically paid based on market prices of roundwood products, and there is no direct support from the industry or government towards cost sharing.

For the overall perception of the landowner stakeholder group in the strength category, the factors of sustainable forestry, access to markets, safety, and reputation explained 40%, 27%, 17%, and 17%, respectively. A high priority value of sustainable forestry is understandable, as forest landowners typically have multiple objectives for forestland management (Butler and Leatherberry, 2004). Inconsistent interpretation and landowner education both explained 28% of perception in the weaknesses category, followed by 24% for no economic incentives and 20% for lack of trained personnel. Perceptions about opportunities were explained by improved training and education (49%), forest-based benefits (29%), and interagency coordination (22%). A high priority value of improved training and education under the opportunity category and landowner education under the weakness category reflects on a common understanding that a large percentage of family forest landowners are unaware of or have limited knowledge of forestry BMPs in Georgia. Regulations and restrictions explained the largest proportion of the threat category at 53%, followed by an accounting of cost sharing and the urban population at 28% and 19%,
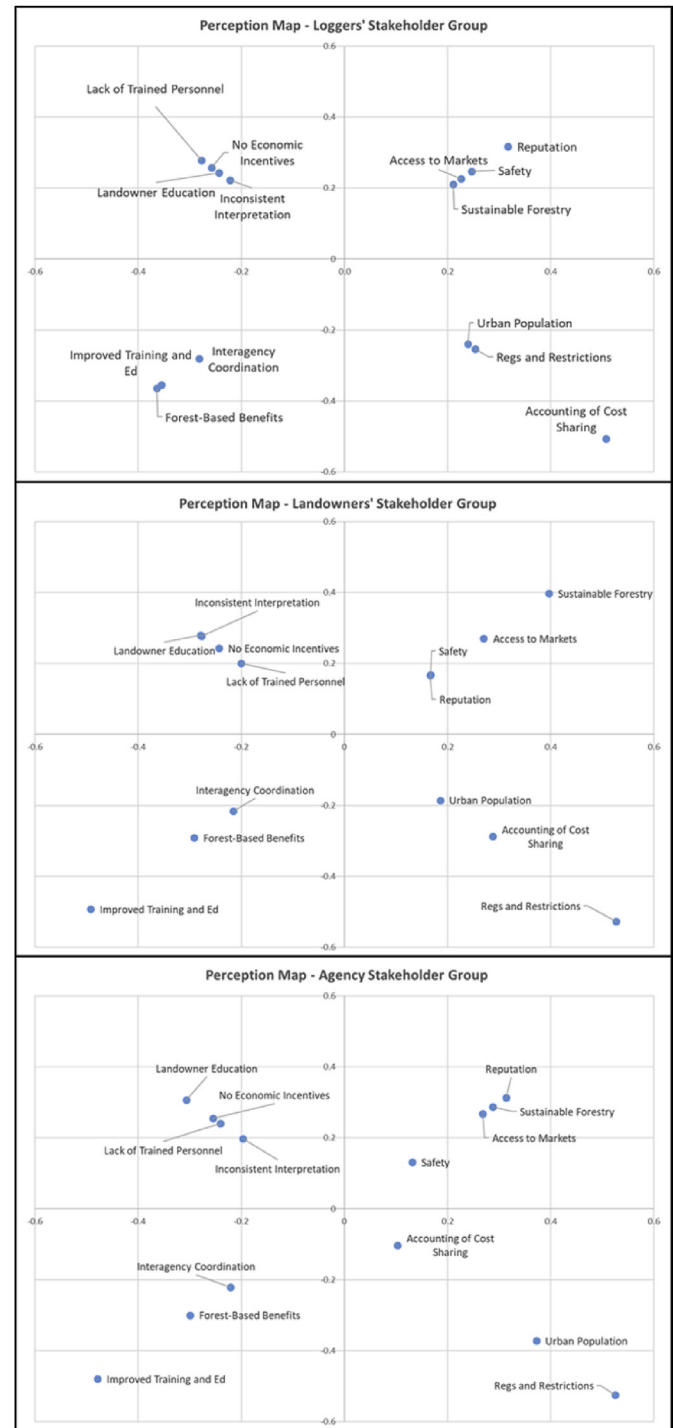

Fig. 2. Perception maps of SWOT factors for each stakeholder group. The further away a factor is from the origin, the more that factor explains the perception of the stakeholder group for a SWOT category. The value of Confidence Ratios are less than 10% for all the pairwise comparisons showing consistency in responses.

respectively.

Within the agency stakeholder group, reputation explained 31% of perception for the strength category followed by 29% for sustainable forestry, 27% for access to markets, and 13% for safety. Under the weakness category, 31% of perception was explained by landowner education, 26% by no economic incentive, 24% by lack of trained personnel, and 20% by inconsistent interpretation. The agency's perception regarding opportunities was explained by improved training and education at 48%, forest-based benefits at 30%, and interagency coordination at 22%. Finally, regulations and restrictions explained 53% of the perception for the threats category, followed by 37% for the urban population, and 10% for an

accounting of cost sharing. A high priority value of 53% for regulations and restrictions under the threat category could be attributed to the general observation that an increase in regulations and restrictions could lead to more interagency coordination issues and increased chances of inconsistent interpretations. In some cases, existing forestry BMPs provide general guidelines, and are subject to different interpretations by different stakeholder groups depending upon local context.

The perceptions of the highest priority factors from each SWOT category for each stakeholder group (Fig. 3) shows they are mostly positive for the landowner and agency stakeholder groups (62% and 64% positive, respectively) and almost equally positive and negative
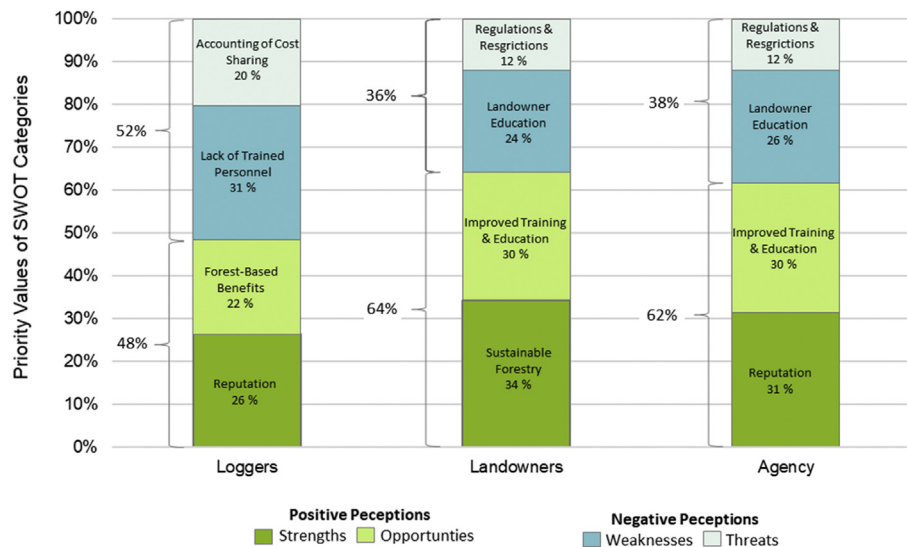

Fig. 3. Highest priority factors under each SWOT category for each stakeholder group. The value of Confidence Ratios are less than 10% for all the pairwise comparisons showing consistency in responses.
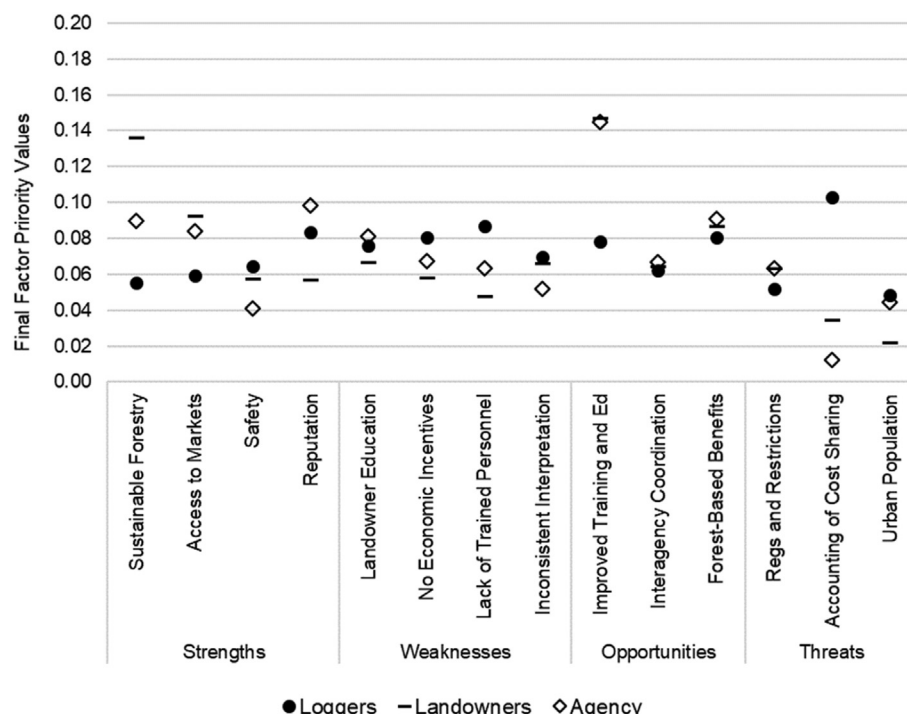

Fig. 4. Final priority of factors for each stakeholder group.

for the logger group (48% positive versus 52% negative). Our results support the findings of Husak et al. (2004) that forestry stakeholder recognize and appreciate the positive benefits of BMPS. The strength category (sustainable forestry) and opportunity category (improved training and education) drove the positive perception of the landowner stakeholder group. Similarly, the positive perception of the agency stakeholder group was dominated by the strength category (reputation) and opportunity category (improved training and education). The weakness category (lack of trained personnel) followed by the threat category (accounting of cost sharing) contributed to the overall negative perception of the logger stakeholder group.

5. Discussions

Sustainable forestry, improved training and education, and accounting of cost sharing showed significant differences across stakeholder groups in terms of overall priorities given to these factors (Fig. 4). Overall, landowners perceived sustainable forestry as having greater importance than the agency and logger stakeholder groups. Conversely, the logger stakeholder group perceived accounting of cost sharing as having greater importance than the landowner and agency stakeholder groups. The logger stakeholder group cited cost sharing as the highest priority factor while it was the lowest and second lowest for agency and landowners, respectively. Landowners and agency perceived improved training and education as their highest priority factor while it held only moderate importance for loggers. Presumably, the landowner stakeholder group is aware of their need for more information on forestry BMPs and the agency stakeholder group is willing to supply the information on forestry BMPs as a part of their organizational mandate.

Under the opportunity category, only the factor forest-based benefits was consistent across all groups among the top five priority factors from each of the stakeholder groups (Fig. 5). This indicates a common understanding exists among selected forestry stakeholder groups about the effects of forestry BMPs on the overall well-being of people and the environment. Agency and landowner stakeholder groups also perceived sustainable forestry and access to markets under the strength category to be one of their top five factors. All stakeholder groups perceived training to be important to BMP implementation, but they differed in their perceptions of whether it should be externally or internally focused. Landowners and agency ranked the external factor of improved training and education under the opportunity category as their top priority, whereas the logger stakeholder group indicated the internal factor of lack of trained personnel under the weakness category as their second top priority. Loggers are responsible for making many BMP decisions and must have the technical knowledge necessary for the execution of BMPs during the harvesting process. An aging workforce coupled with the difficulty of providing hands-on field training to younger loggers towards forestry BMPs were concerns raised by the logger stakeholder group. Other than forest-based benefits, the only other top five factor that the logger stakeholder group shared with another stakeholder group was reputation under the strength category with the agency stakeholder group. Following forestry BMPs is a tangible way to demonstrate a commitment to responsible and sustainable forestry, and therefore, improve the public reputation of the logging as a profession.

Overall, our results suggest that the perspectives of the logger stakeholder group about forestry BMPs in Georgia vary noticeably from the landowner and agency stakeholder groups. The cost of BMP implementation was one of the biggest concerns of loggers with an accounting of cost sharing (threat) and no economic incentives (weakness) comprising over 18% of the overall perception
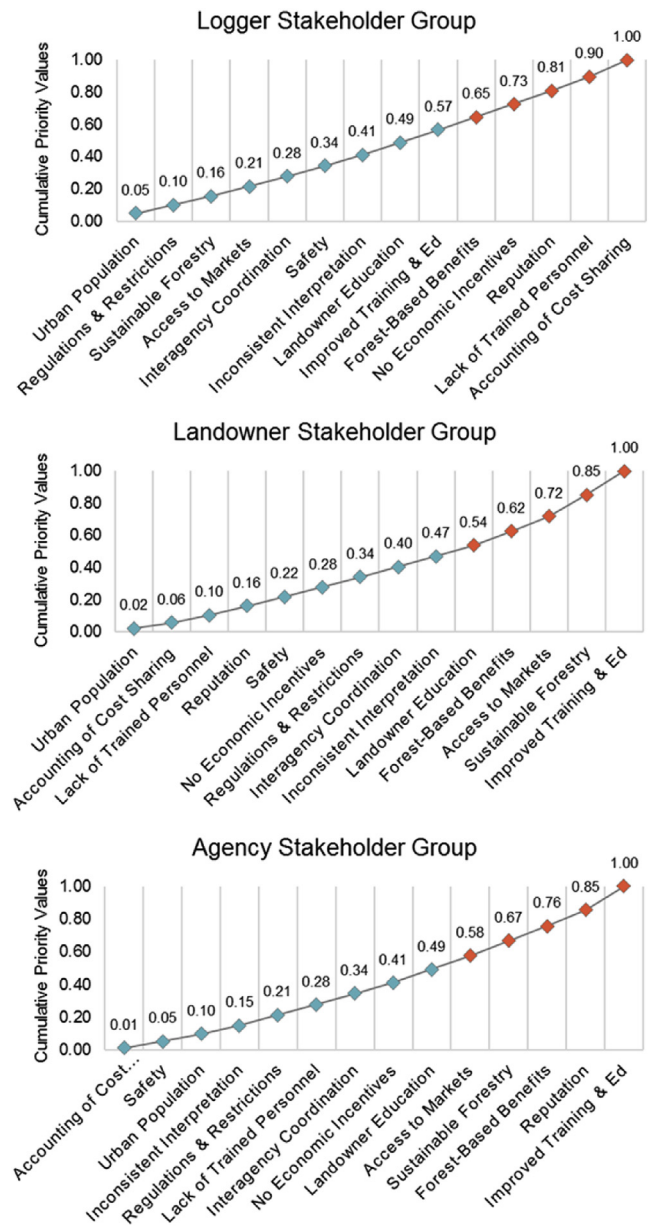

Fig. 5. Final order of factors for each stakeholder group. Top five factors are highlighted.

of forestry BMPs. A survey conducted by Blinn et al. (2001) suggested that loggers are concerned about paying much of the costs of implementing forestry BMPs without adequate compensation. This is especially true in light of the fact that forestry BMP implementation costs are increasing (Cubbage, 2004). Sun (2006) explored welfare effects of forestry BMPs and reported that while consumers of forest products had the largest absolute welfare loss from costs related to the implementation of forestry BMPs, loggers experienced the greatest relative welfare losses with landowners sharing the burden, while mills experienced little change to their welfare. A study found that the tight profit margin of timber harvesting makes a realistic accounting of the costs of forestry BMPs in bidding processes an important determinant for profitability, but not all loggers are doing this well (Germain et al., 2016). Considering this, it is not surprising that financial burdens overshadow

most other factors for loggers coupled with a shortage of qualified employees. We also found the perceptions of landowner and agency stakeholder groups were very similar and focused mostly on educational needs. This reflects that fact that the majority of forest landowners are not well aware of forest-related issues and agency and extension professionals are continuously trying to encourage their broader participation in forestry-related educational programs (Measells et al., 2006).

6. Conclusion

We used the SWOT-AHP (Strengths, Weaknesses, Opportunities, and Threats analysis with the Analytical Hierarchy Process) framework to assess perceptions of three stakeholder groups (loggers, landowners, agency foresters) about forestry BMPs in Georgia to identify potential conflicts among identified stakeholder groups and use the same information for effective policymaking. Based on our findings, we suggest the following for ensuring greater coordination among selected stakeholder groups:

- A state-wide education program should be developed for forest landowners to inform and educate them about the importance of sustainable forestry management in general, and forestry BMPs, in particular.
- An in-the-field training program should be developed to provide young loggers with hands-on, practical education about implementing forestry BMPs. This is critical as lack of trained manpower could adversely affect BMP implementation rates in coming years.
- A platform should be developed where members of logger, landowner, and agency stakeholder groups can discuss issues related to forestry BMPs at regular intervals. This will help in better coordination and in bringing clarity about the interpretation of forestry BMPs. This will also build trust among identified stakeholder groups leading to synergetic solutions to point of conflicts.

We have not included the industry stakeholder group in this analysis. We hope that future research will incorporate perceptions of industry stakeholder group. Additionally, the potential solutions that we have proposed are based on inputs received from stakeholder groups at the time of undertaking focus group discussions and surveys. It will be nice to prioritize suggested solutions using a similar approach in the future research. We hope that our study will fill a critical gap that exists in our understanding on perceptions of stakeholder groups about forestry BMPs in Georgia and will lead to better policy formulation for sustaining higher BMP compliance rates. We are also hopeful our study will help other states in engaging local stakeholder groups in a constructive manner for the betterment of people and forestry resources alike.

Appendix 1. Explanations of factors under the SWOT categories.

Strengths

Promotes Sustainable Forestry
    BMPs protect water quality, prevent soil erosion, and support biodiversity.
Maintains/Increases Access to Markets
    Following BMPs is a contractual requirement for doing business with many mills.
Promotes a Culture of Safety
    Following BMPs helps in promoting the safety of logging employees.
Improves Reputation of Logging Community
    By following BMPs, the public's perception of the logging community is improved.

Weaknesses

Lack of Landowner Education
    Some landowners may have limited knowledge about the relevance of BMPs which can result in conflicting forest management and harvesting goals.
No Economic Incentives
    The cost of BMP implementation is not recognized by the market or regulatory agencies.
Lack of Trained Personnel
    Newer logging employees are not receiving thorough hands-on training.
Inconsistent Interpretation of BMP Guidelines
    BMP guidelines can be interpreted in different ways which lead to conflicts between stakeholder groups.

Opportunities

Improved Training and Educational Opportunities
    Training opportunities for loggers should include hands-on/field training. Additional educational opportunities for forestry workers, regulators, and enforcement officials could improve consistency in interpretation of BMP guidelines.
Better Interagency Coordination
    Coordination between local and state agencies could be improved to better report, monitor, and coordinate compliance related issues especially with tightening state budget.
Maintenance of Forest-Based Environmental Benefits
    BMPs help in maintaining environmental benefits (e.g., soil conservation, biodiversity, water quality, air quality, wood supply) which improve the overall well-being of people across regions.

Threats

More Regulations and Restrictions
    More regulations and restrictions could place extra burdens and costs on stakeholders.
Insufficient Accounting of Cost Sharing
    It is unclear exactly how much of the cost of implementing BMPs is shared amongst players in the forest products supply chain. Inequity can lead to discontent within groups who feel they are paying more than their fair share.

Increasing Urban Populations

Increasing urban populations with little or no exposure to working forests and BMPs could lead to less representation of forestry interests in the legislative process.

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