




## Article

# A Comparative Analysis of Five Forest Certification Programs

Alba Rocio Gutierrez Garzon <sup>1,\*</sup>, Pete Bettinger <sup>1</sup>, Jacek Siry <sup>1</sup>, Jesse Abrams <sup>1</sup>,  
Chris Cieszewski <sup>1</sup>, Kevin Boston <sup>2</sup>, Bin Mei <sup>1</sup>, Hayati Zengin <sup>3</sup> and Ahmet Yeşil <sup>4</sup>

<sup>1</sup> Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602, USA; pbettinger@warnell.uga.edu (P.B.); jsiry@uga.edu (J.S.); jesse.abrams@uga.edu (J.A.); biomat@uga.edu (C.C.); bmei@uga.edu (B.M.)

<sup>2</sup> Norwegian Institute of Bioeconomy Research, Postboks 115, NO-1431 Ås, Norway; kevinboston@hotmail.com

<sup>3</sup> Faculty of Forestry, Düzce University, 81620 Düzce, Turkey; hayatizengin@duzce.edu.tr

<sup>4</sup> Faculty of Forestry, İstanbul Üniversitesi-Cerrahpaşa, 34320 Istanbul, Turkey; ayesil@istanbul.edu.tr

\* Correspondence: garzon@uga.edu

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**Abstract:** International expansion of forest certification programs has occurred over the last three decades. Both public and private organizations have shown increased interest in becoming certified by one or more forest certification bodies, to assure the public that forest resources are managed adequately in sustaining forest health and socio-economic viability. The Forest Stewardship Council (FSC) program is globally used as a benchmark to implement forest certification at the national and regional levels. The Sustainable Forest Initiative (SFI) and the American Tree Farm System (ATFS) are also used throughout the United States. In Europe, individual countries such as Bulgaria and Turkey have also developed national forest certification programs. The SFI, ATFS and Bulgarian programs are further endorsed by the Programme for the Endorsement of Forest Certification (PEFC). The results of a qualitative analysis comparing the FSC forest certification program with the SFI, the ATFS, and the two European national programs (Bulgarian and Turkish) suggest that differences in these programs are not necessarily related to their language, but to the level of detail and prescriptiveness of each program. We find that the FSC is much more detailed and prescriptive in nearly all aspects considered for forest certification. In particular, we find that most of the elements considered in the FSC Principle 6 (Environmental Impact) are either only superficial, or not addressed at all, in the other four programs. Furthermore, the other programs appear to be less comprehensive and detailed in the substance of the FSC monitoring and assessment principles. In a few areas, the Turkish program requires more quantitative indicators for assessing forest management than the other programs. Though a comparison of the legal framework related to forest management in each of the studied countries was briefly introduced, our study focuses on the certification schemes themselves; it may contribute to policy discussions in the future development and implementation of other certification programs.

**Keywords:** ATFS; FSC; SFI; policy; sustainability; Turkey; Bulgaria; United States

## 1. Introduction

One of the earliest certification processes, the American Tree Farm System (ATFS), was developed in 1941 to improve forest management practices on private lands in the United States through education and self-discipline, under forest production and protection premises [1]. This concern for sustainable forest management is held by many private landowners, as about 74,000 family forest owners are currently enrolled in the ATFS program, representing 7.69 million ha (19 million acres) of forest land

in the United States [2]. In the early 1990s, the promotion of a more contemporary understanding of “sustainability” was further advanced through the development of other certification programs that promote sustainable forest management and potentially help forest landowners (individuals, organization, companies, etc.) address market requirements [3,4]. The development of some forest certification programs has been prompted by environmental requirements and the increasing concern over deforestation and forest degradation in the tropics, which have also led to the addressing of social issues associated with plantation forestry [3,5,6]. Today, forest certification is also sought by landowners and other organizations to enhance their public image [7] and to signal to consumers that forests are being sustainably managed [8]. Despite some differences across programs, contemporary certification processes generally consist of five steps: (1) initial contact with the certifying body, (2) a pre-assessment, (3) an on-site verification visit, (4) certification approval, and (5) subsequent audits, inspections, and re-certification when applicable.

Over the last three decades, forest certification programs have evolved, with all now including standards, criteria and indicators of performance. In general, when a forest is enrolled in a certification program, the forest management practices employed are assessed against a series of standards to assure consumers that the wood products produced come from a forest managed under independently verified ecological, economic and social sustainability principles [9]. When compared with traditional state-led regulation, forest certification may lead to more timely changes in forest management practices [1,10]. One recent survey of foresters suggested that certification might positively affect overall forest management [11]. In addition to strengthening forest management practices, forest certification programs have also been shown to facilitate improved dialogue among stakeholders, thus enhancing sustainable forest management [12].

From a global perspective, the Forest Stewardship Council (FSC), the Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certification (PEFC) are three of the most well-known forest certification organizations. The FSC program emerged in response to the failure of international bodies to address the loss of high conservation value forests, particularly in the tropics [13]. The FSC program was initiated, and continues to be managed, by a non-governmental organization; membership is open to private, community, and tribal landowners, as well as many governmental forest owners. The FSC has developed a formalized stakeholder structure in which the primary governing body is an international general assembly composed of three chambers to which members that want to join may apply: environmental, social and economic. Each chamber is further divided into a northern and southern sub-chamber, with equal representation [14]. One of the main functions of that government body is to approve regional and national forest management standards developed by the corresponding working groups. Public input is required, particularly in the development of regional standard processes. Membership in the FSC is voluntary, but each applicant needs the support of at least two other members [15]. The FSC requires third-party audits once every five years by auditors accredited by the FSC, in addition to annual surveillance audits to verify continual compliance with the FSC certification requirements [16]. Although the SFI program currently has rigorous standards, now independently managed, it was established by the American Forest and Paper Association in 1993 as a less prescriptive alternative to FSC [17]. The PEFC program was established in 1999 in response to environmental, socio-economic, political and cultural issues of forest landowners in Europe, and now acts as an umbrella organization that endorses forest certification systems through independent third-party certification. In 2004, the first non-European national standards (Australia and Chile) were endorsed under the PEFC umbrella [18]. Today, the SFI and ATFS programs are also endorsed by the PEFC program, and the SFI showed the greatest growth in 2018 among PEFC-endorsed programs [19].

In places where there is legitimate sovereign control over forest management standards, certification schemes exist as complements to, rather than substitutions for, legal forest management standards. As [20–22] and others have noted, regulatory policy and state capacity play important roles in creating and enabling environments for the adoption of certification. Governmental entities may go beyond simple context-setting roles, to actively develop, encourage or frustrate various

certification schemes [23–25]. While individual landowners and forest management organizations independently seek forest certification, a forest certification program can also be driven by national concerns and applied in a widespread manner throughout a country. For example, Turkey's forests cover about 26.7% of the country's land area, and more than 99% of the forests in Turkey are owned and managed by the government [26,27]; therefore, a single program addressing all national concerns was developed. In the process, the Ministry of Agriculture and Forestry included the General Directorate of Combating Desertification and Erosion and the General Directorate of Nature Conservation and National Parks when developing the comprehensive national standard. Because Turkey covers three phyto-geographical regions (Euro-Siberian, Mediterranean and Irano-Turanian), the General Directorate of Forestry blended criteria and indicators adopted from Pan-European and Near East forest certification efforts. The Near East process was used as the base because of its wider range and overlapping characteristics with Pan-European criteria [28]. The observation, evaluation, planning and reporting processes of the Turkish program are now conducted by the General Directorate of Forestry. Although the Turkish government has only recently begun using the national program, about 2.4 million hectares (10.7%) of forests in Turkey, as of 2014, were also certified under the FSC program [29]. In 2019, Bulgaria obtained endorsement from the PEFC program for its national forest certification program. Under this program, the verification of standards is conducted by an independent third-party organization, which meets the requirements of ISO 17011 [30].

As the demand for forest certification by public and private landowners continues to increase worldwide, there is concern that consumers of forest products might conclude that all certification standards are equivalent (which may not be true), and there is also a lack of a mechanism to allow consumers to determine which program label pertains to the most sustainably managed forests [31]. Further, interest has arisen in comparing the relative strengths and weaknesses of certification programs from academic institutions in southern Europe. Recent research on this subject has investigated the process of forest certification through the FSC program in North and South America [3], the challenges facing the implementation of national standards for sustainable forest management in Chile, Argentina and Uruguay [32], the challenges facing FSC certification in Nepal [33], and the motivations to adopt FSC- or PEFC-endorsed programs in Chile [6]. The objective of this research is to compare the forest management certification standards most commonly used in North America (FSC, SFI, ATFS) with each other, and with two southern European standards (Turkish, Bulgarian). It is important to note that in the United States, more than half of the forest land is privately owned, while forest land in Turkey and Bulgaria is primarily publicly owned (99% and 89%, respectively) [26,27,34,35]. Consequently, it is expected that this difference in land ownership signature may influence the emphasis each program places on certain standards [4]. Comparisons of the five forest certification programs will be made along one specific line: the equivalence and prescriptiveness of four programs (SFI, ATFS, Turkish, Bulgarian) when compared to the FSC program in the United States. It is important to underscore that our analysis focuses exclusively on the requirements and frameworks associated with the certification schemes themselves, and not on the broader legal and regulatory frameworks present in each of our studied countries. Nonetheless, a brief survey of these frameworks is provided in the results section.

## 2. Methods

This research involved documentary work describing the differences in characteristics among forest certification programs based on published materials provided by those programs. The current FSC-US, SFI and ATFS standards were obtained directly from each organization's Internet site [36–38]. Containing 10 principles, 55 criteria and 200 indicators related to the management of forests, including requirements for biodiversity, pesticide use, worker rights standards, local and indigenous groups' rights to traditional uses of the forest, etc. (Table 1), the FSC program likely has the highest global recognition amongst these programs [27].

**Table 1.** Forest Stewardship Council (2010) principles used in the comparison.

1	Compliance with laws and FSC principles
2	Tenure and use rights and responsibilities
3	Indigenous peoples' rights
4	Community relations and worker's rights
5	Benefits from the forest
6	Environmental impact
7	Management plan
8	Monitoring and assessment
9	Maintenance of high conservation value forests
10	Plantation management

The SFI forest management certification program contains 15 principles (Appendix A Table A1), 37 performance measures and 101 indicators. The ATFS program contains 8 standards (Appendix A Table A2), 14 performance measures and 22 indicators. The Criteria and Indicators for Turkish forests were obtained from the General Directorate of Forestry Internet site [39]. The Turkish program consists of 6 criteria (Appendix A Table A3), 40 quantitative indicators and 11 qualitative indicators. The Bulgarian forest management standards were acquired from the PEFC website. The Bulgarian program contains 6 criteria (Appendix A Table A4) and 41 indicators [40]. Additional characteristics of these five certification programs are shown in Table 2.

**Table 2.** Forest certification programs analyzed: general characteristics.

Program Name	Enforcement	Endorsement	Scope	Type	Costs
Forest Stewardship Council	Voluntary		International	Performance-based	Minimum variable <sup>a</sup>
Sustainable Forestry Initiative	Voluntary	PEFC	North American	Systems-based	Variable <sup>a</sup>
American Tree Farm System	Voluntary	PEFC	National	Performance-based	Free <sup>b</sup>
Turkish Criteria and Indicators for Sustainable Forest Management	Mandatory <sup>c</sup>		National	Performance-based	None <sup>d</sup>
Bulgarian forest certification system—Standard for Sustainable Forest Management	Voluntary	PEFC	National	Systems-based	Unknown

<sup>a</sup> Depending on mainly ownership size class, tract size and region [41]. <sup>b</sup> For individual certification. <sup>c</sup> Submission of a periodic report. <sup>d</sup> All data are gathered by official institutions, there are no apparent additional costs.

The five forest certification programs were developed independently; three were written in English and two were translated to English. During this investigation, we found that a *standard* can refer to the entire set of criteria and indicators of a program, or to a specific area of emphasis within one of these programs. Therefore, for the analysis presented here, we employ the generic term *program* to refer to each of the five collections of standards, criteria and indicators. This approach is meant to avoid any confusion with the use of the term *standard*. Being perhaps the most complex of the five programs (Table 3), and knowing that in general the FSC program seems to have more elaborate ecological and social criteria and indicators [31], we chose it as the benchmark against which others were to be examined.

To address our main line of investigation, we reviewed the main document of each certification program to determine whether topics related to each FSC principle were acknowledged. Definitions and glossaries of terms were not analyzed even if they were included in the program's main document. However, we did review Appendix C of the FSC program in order to be precise in assessing the substantiveness of their Principle 6, which includes additional requirements and guidance for the regions of the United States. We sought equivalence between the FSC principles and similar aspects of the other four certification programs. We carefully searched the other four certification programs for correspondence with each topic within each FSC principle, and, if located, we noted the extent to which

the topic was described or mentioned in the other programs. We analyzed all 10 FSC principles and examined whether the programs appeared to require evidentiary demonstrations of forest sustainability by establishing thresholds for a minimum acceptance of a requirement. Where appropriate, we describe certification programs as being substantive when specific on-the-ground forest practices are required, procedural when practices appeared to be suggested, and mixed when practices appeared to involve both the substantive and procedural policy styles to some degree [42].

**Table 3.** Structure of forest certification programs analyzed.

Name of Forest Certification Program	Description
Forest Stewardship Council	10 Principles 55 Criteria 200 Indicators
Sustainable Forest Initiative	13 Principles 15 Objectives 37 Performance measures 101 Indicators
American Tree Farm System	8 Standards 14 Performance measures 22 Indicators
Turkish Criteria and Indicators for Sustainable Forest Management	6 Criteria 40 Indicators 216 Variables 11 Qualitative and descriptive indicators
Bulgarian Forest Certification System—Standard for Sustainable Forest Management	6 Criteria 41 Descriptive indicators

### 3. Results

Although we have not preformatted the formal analysis of the forest policy frameworks on any of the studied countries, we set the stage for the analysis of the forest certification programs by first providing a brief overview of the forest policy context in which forest landowners operate in the United States, Bulgaria and Turkey. In the United States, about 56% of the forest land is privately owned, 33% is owned by the federal government, and about 11% is considered as other public land [43]. For national forest lands, a number of statutes govern the management and planning of forest activities [44], including the National Environmental Policy Act (42 U.S.C. §§ 4321–4347), the National Forest Management Act (16 U.S.C. §§ 1600–1614) and the Endangered Species Act (16 USC 1531–36, 1538–40). A number of these laws relate only to the management of national lands, however some national laws, such as the Endangered Species Act, the Clean Water Act (33 U.S.C. §§ 1251–1387) and the Clean Air Act (42 U.S.C. §§ 7401–7602) also pertain to, or affect, the management of private and other public lands. For example, most states have developed Best Management Practice (BMP) guidelines for forest landowners that serve to meet the goals of the Clean Water Act and other laws. Some states (e.g., California, Maine, Oregon and Washington) have also developed state-level forest practices laws that regulate the actions of private and state forest lands. Various counties and cities have also developed other regulations that affect public (county or city) and private forest land management. An example is the environmental review of forest practices that is required under certain circumstances in Pierce County, Washington [45]. The policy environment is therefore quite diverse depending on the type of land (public (federal, state, county, city, etc.) or private) and the state in which the land is located. In addition to complying with applicable laws, landowners (public and private) can attempt to certify their forests so as to demonstrate that they are being sustainably managed. However, certification is a voluntary endeavor.



In Turkey, the forest area covers about 29.2% of the land, of which 99% is owned and managed by the state, and the remaining 1% is either owned by non-state public entities or private entities. Privatization is considered in Turkey a drawback to the public benefit. The nationalization of nearly all forest areas in Turkey occurred in 1945 through Law 4785 [46]. The administration of state forests is organized hierarchically in 28 Regional Forest Directorates controlling 246 State Forest Enterprises, which comprise a total of 2140 Forest Chiefdoms (also called forest units) [47]. Forest-related legislation in Turkey includes Article 169 of the Turkish Constitution of 1982, which delegates the General Directorate of Forestry as the agency responsible for managing, exploiting and protecting the state-owned forests in Turkey. The related laws in Turkey include: the statutory laws, of which Forest Law 6831 of 1956 is fundamental for forest management activities; regulatory laws, such as the Forest Planning Regulation and the Forest Afforestation Regulation; and the Forest Exploitation Regulations [48]. In addition, one of the most important restrictions of forest lands is given in the National Parks Law 2873, which designates protected areas where timber production is prohibited. Other laws that also support forest management activities are the Soil Conservation and Land Use Law 5403, Agriculture Law 5488 Pasture Law 4342, Environmental Law 2872 and the Afforestation Regulation [47]. It has been found that while 40% of the forest industry firms in Turkey do not experience problems in sales due to the absence of certification, 90% of them believe that certification is indispensable [49]. For this reason, the General Directorate of Forestry started the certification of forest management activities in 2010 so as to meet the certified products demand of the wood products market [11,50].

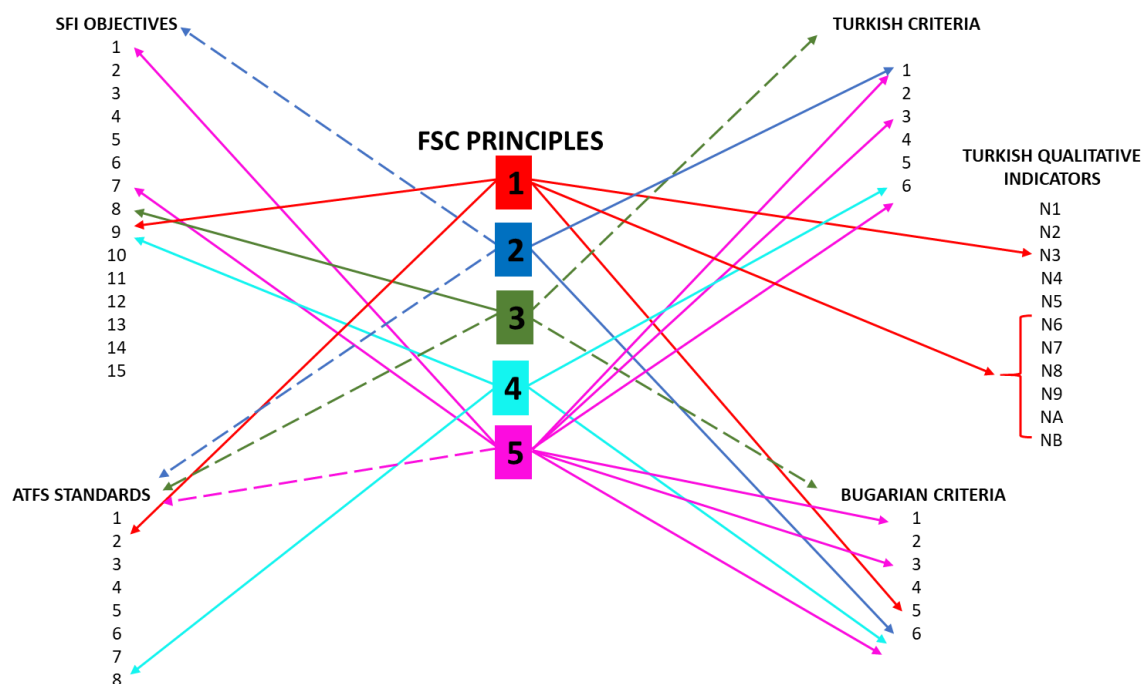
In Bulgaria, the state owns about 74% of the forest land, and about 12% is owned by municipalities, about 11% by private landowners, and the remainder by other land ownership groups [51]. All forms of forest land ownership are equivalent, thus the Forest Act (SG No. 19/8.03.2011), among other regulations, ordinances and orders, guides the management of all forests in Bulgaria. The Regional Forest Directorates of the Executive Forest Agency control forest activities, and managed and farmland forests require a forest management plan or extraction plan before wood can be harvested, regardless of ownership [52]. Forest certification is a voluntary endeavor, but within the guise of the Forest Act, special preference for harvesting large volumes of wood and for the development of management plans is given to organizations that have certified their forests [52].

The associations between the FSC program principles and the objectives, standards, criteria or principles of the other programs is complex (Figures 1 and 2). In the following subsections, we describe the main similarities and differences among these, with each FSC principle as a reference point (see also Table 4).

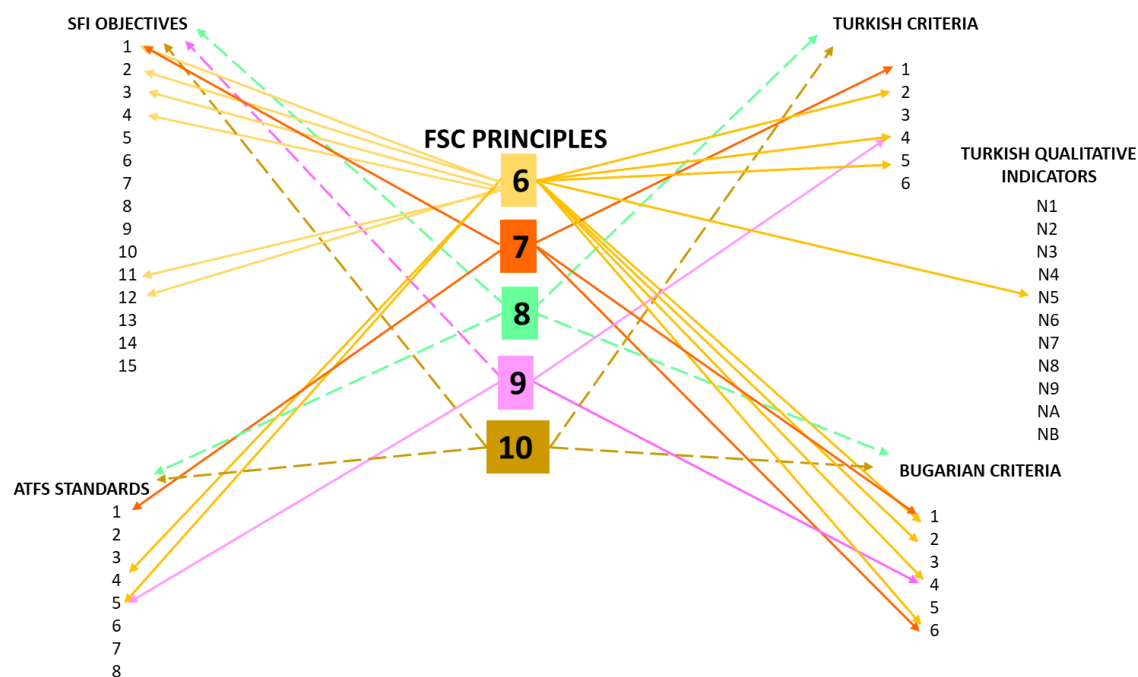
**Table 4.** Consistency among certification programs for the FSC principles.

Forest Stewardship Council Principles	1	2	3	4	5	6	7	8	9	10
In comparison with:										
Sustainable Forestry Initiative objectives	9	NP	8	9	1 7	1 to 4 11 12	1	NP	NP	NP
American Tree Farm System standards	2	NP	NP	8	NP	4 5	1	NP	5	NP
Turkish Criteria and Indicators for Sustainable Forest Management	N3 N6-N9 *	1	NP	6	1 3 6	2 4 5 N5	1	NP	4	NP
Bulgarian Forest Certification System—Standard for Sustainable Forest Management	5	6	NP	6	1 3 6	1 2 4 6	1 6	NP	4	NP

NP: Not Present; \* Refer to Table A3 for description.



**Figure 1.** Consistency among certification programs for FSC principles 1 to 5. (Dashed lines “—” indicate the absence of a specific requirement or language related to the specific FSC principle).



**Figure 2.** Consistency among certification programs for FSC principles 6 to 10. (Dashed lines “—” indicate the absence of a specific requirement or language related to the specific FSC principle).

### 3.1. Principle 1: Compliance with Laws and Principles

The FSC program contains more indicators to account for regulatory compliance, and is more detailed in the description of these requirements than the other programs. In general, the FSC and SFI programs use similar language in regard to compliance with laws and regulations, although the FSC program requires landowners to consider complaints and investigations associated with certified forests for a 5-year period prior to certification assessment.

The SFI program refers to this principle under its Objective 9, and like the FSC program it mentions accounting for the compliance of applicable forest laws and regulations, and requires a commitment to social sustainability (e.g., worker's compensation, prevailing wages, people's rights, etc.). In contrast, the FSC program also directs its principles towards supporting activities that avoid the illegal harvesting of trees. The SFI program requires participants to demonstrate a commitment to legal conformance through the available regulatory action information, which refers to regulatory compliance data compiled by national, provincial or state, and local agencies [53]. While conformance is the intent within the SFI program, the spirit and general record of compliance is really what is encouraged.

The ATFS program refers to this principle in its Standard 2; however, the standard is much briefer and more permissive than the FSC program. While the ATFS program is less prescriptive, it is clear that compliance with laws and regulations relevant to forest management is required within the certified forest area. The ATFS proposes a three-tiered process to verify compliance, which appears to be rather flexible (e.g., verbal or written claims of legal compliance). Further, the ATFS program recognizes that landowners might make mistakes in implementing management practices, but landowners need to correct them once full knowledge has been acquired.

Within the Turkish program, Indicator N3 relates to the legal and regulatory framework for the implementation of forest management, and could be comparable to this FSC principle. It is important to note that the indicators contained in the Turkish program are all related to policy and institutional frameworks. Within the Turkish program, the National Forest Law Articles are cited often, prompting the need for permission for certain activities (e.g., mining). Furthermore, policies, institutions and instruments are adopted under each criterion of the Turkish program, and appear within the list of qualitative and descriptive indicators, rather than as separate criteria.

Criterion 5 of the Bulgarian program corresponds to this FSC principle. In the Bulgarian program, compliance with similar language in the PEFC program and with European Union legislation is mandatory. Conformance with legal, regulatory and other specific requirements and applicable legislation at the national and international level, including the PEFC guidelines, appears under each criterion. Like the FSC program, the Bulgarian program also requires the avoidance of illegal activities, and proof of preventive and corrective actions of the occurrence of such. The aspect of knowledge and experience in the Bulgarian program is shared with the FSC requirement, in that not only do professionals and contractors need to have knowledge of all applicable laws and regulations, but also employees and workers must be experienced and sufficiently competent to perform the management tasks (for example, through training and supervision). With respect to this area of concern, the FSC program is the most substantive. The Bulgarian program represents a mixed approach, and the other three programs represent the procedural policy style.

### *3.2. Principle 2: Tenure and Use Rights and Responsibilities*

Within the FSC program, the legal right to manage forest resources needs to be clearly defined and demonstrated by the certificate holders. The term "tenure" within the SFI program includes a requirement of being aware of the forest land ownership status. The ATFS program does not have a specific requirement for landowners to present evidence of long-term forest use rights. As nearly all forest land in Turkey is owned by the government, Criterion 1 (indicator 1.4 Forest cadaster) of the Turkish program is meant to assess forest land ownership through documentation of forest use rights, but it is not specific. Criterion 6 in the Bulgarian program addresses part of this principle, in that the right of use and ownership of forest resources needs to be defined, demonstrated and taken into account within a forest plan. With respect to this area of concern, the FSC program is the most prescriptive in comparison to the other four programs.



### 3.3. Principle 3: Indigenous Peoples' Rights

The FSC program notes that indigenous peoples' rights should be recognized and respected, and provides a series of actions to consider in order to achieve these goals. Although the FSC program encompasses more criteria and indicators associated with this principle, the SFI program is very similar, as noted through the terminology used in SFI Objective 8. An important detail to mention is that the FSC program requires consultation with tribal representatives in order to develop measures to ensure protection of their rights and resources, while the SFI program only addresses this matter as it pertains to public lands. In addition, one component that is less clear in the SFI program involves compensation for the application of traditional knowledge (which is required under the FSC program). This type of indigenous peoples' rights standard is absent in the ATFS, Turkish and Bulgarian programs. This is understandable in the Turkish case, as there are no communities in an indigenous people's category in Turkey or Bulgaria. However, people who live near the forests, and forest villagers, have rights that emanate from the Forest code; one mission of forestry in Turkey is to contribute to the welfare of these people. They can be employed through forestry activities and they can benefit from products derived from these through lower prices.

### 3.4. Principle 4: Community Relations and Workers' Rights

The FSC program places community relations and workers' rights together to highlight the importance of supporting both the local economy and the well-being of communities. In the SFI program, compliance with social laws and workers' rights are considered within Objective 9. In the FSC program, there is greater focus on, for example, the consultation components (or "right to know", as stated in the SFI program), and potential compensation or mitigation measures for loss of or damage to people's property and resources. Both of these programs require compliance with core conventions from the International Labor Organization. However, mechanisms for addressing disagreements between workers and management are not specifically outlined in the SFI program. This FSC principle is briefly addressed under ATFS Standard 8, mainly advising landowners to hire contractors who have adequate insurance, to abide by fair labor rules, and to have a record of compliance with applicable law and regulations. Criterion 6 of the Turkish program seems to be most comparable to this FSC principle. Aspects such as considerations for hiring local employees (forest villagers), non-discrimination and the enhancement of local communities appear to be accounted for under this indicator. Nevertheless, emphasis is placed on the scope of employment, rather than other rights, such as fair wages. The Turkish program focuses on determining the number of appeals and complaints, but a process to resolve disputes is not required. Criterion 6 of the Bulgarian program gives brief attention to this FSC principle. Compliance with International Labor Organization conventions is mentioned, as well as the right that workers should have to associate with other employees when negotiating conditions of employment. The resolution of potential conflicts related to the management of forest resources is also mentioned, and seems to focus on applying the appropriate legislation (e.g., labor rights, rights of use, etc.) to each situation. In general, with regard to this FSC principle, the five programs take a procedural mandatory policy approach.

### 3.5. Principle 5: Benefits from the Forest

Locality (e.g., use of local products and employment) is emphasized in the FSC program under this principle, as are requirements to minimize harvest waste and loss, and to promote forest product diversification. Objective 7 of the SFI program addresses some of the same requirements in terms of the management of harvest residue and waste, and suggests the exploration of alternative markets. In addition, considerations about sustained harvest levels included under this FSC principle are described within SFI Objective 1, but in less detail. The ATFS program refers to sustainable harvest levels by requiring an organization to achieve adequate timber stocking, according to both the landowner's objectives and applicable regulation. The ATFS program does not mention the

management of residues and waste specifically, though it is considered a visual quality measure. Nor does the ATFS program specify the marketing of products, but non-timber products are included in the definition of forest products. Within the Turkish program, Criterion 6 can be interpreted as addressing economic viability and offering support to local forest landowners and communities. The aspect of sustained yield harvest levels might be included under Criterion 1 of the Turkish program, where detail is provided about the distribution of growing stock, and within Criterion 3, about forest production and wood increment, illustrating the balance between harvest and growth. Criterion 3 of the Turkish program addresses the capability of a forest to produce goods and services. Although it includes some of the FSC principle elements, information about the harvest of forest products is not contained within the criteria, but rather at the end of the document where implementation of the standard is described. Criterion 6 of the Bulgarian program could also be seen as comparable to this FSC principle, as it requires the promoting of rural development and encourages local production and employment, although the FSC program's language is more detailed. The issue of harvest residue management is not addressed in the Bulgarian program, but management of waste is addressed under Criterion 2. Criterion 1 of the Bulgarian program mentions that forest management must ensure a balance between use and growth, which is comparable with the FSC program's requirement of a sustained yield harvest. Criterion 3 also alludes to this requirement, but in relation to non-wood products, hunting and fishing. Both the FSC and the Bulgarian programs clearly state the need to conduct harvesting operations in such a manner that they do not negatively affect forest ecosystem functions. For this aspect, the FSC program remains the one that shows a broader scope of the aspects to consider under this principle, though specific thresholds are not evident. The SFI and ATFS, and the Turkish and Bulgarian programs resemble a procedural policy approach.

### 3.6. Principle 6: Environmental Impact

The FSC program classifies environmental impacts as being both short- and long-term. Each type is defined, and examples of how each could be interpreted across a landscape are suggested. The FSC program requires certified forest owners to conduct a baseline assessment of resources to be incorporated into management planning. Although there is no specific quantitative indicator, the FSC program requires the maintenance of naturally occurring processes, which could be assessed through the density and size of trees, and the application of silvicultural systems and harvesting practices that contribute to such a goal. With regard to silvicultural systems, the FSC program sets thresholds for harvest opening limitations according to the region and requires spatial-temporal details of the opening areas. For rare, threatened and endangered species, the program specifically requires the assessment of certain species and the protection and enhancement of unique habitats. For large ownerships, consideration of diversity as well as habitat connectivity at the landscape scale is suggested.

The SFI program is similar in many respects. While the SFI program does not require the same level of substantive compliance as the FSC program, it requires the accounting for, and documenting of, potential impacts on biodiversity, soil productivity and social values. For example, Objective 4 of the SFI program mentions the use of scientific information to inform management practices, the protection of threatened and endangered species and forests of exceptional conservation value, and the conservation of old-growth forests, among other issues. The FSC program has more specific requirements for rare, threatened or endangered species, whereas the SFI program requires awareness of rare forested natural communities and the development of a program to protect such species. Thus, the prescriptiveness of this SFI objective is low (no specific thresholds), and instead the procedural approach of this standard is evident. Similarly, language regarding the protection of old-growth forests is more specific in the FSC program, whereas the SFI program does not include the concepts of maintaining, restoring or enhancing natural processes, as described in the FSC program. In general, the performance measures within this objective are assessed by the presence of a program (e.g., a program to incorporate biological diversity, a program to protect endangered species, among others) and the development of additional documents, such as wildlife plans and criteria, and the implementation of practices.

Some aspects of this FSC principle are addressed in the ATFS program. For example, under Standard 5 the accounting for potential management impacts on forest health is noted. In the ATFS program, the topic of rare, threatened and endangered species is a mandatory component of a forest plan. However, a landowner is not required to perform an extensive search for threatened or endangered species; instead, they merely need to show a good-faith effort to identify their presence or absence. The program requires that landowners consult with professionals and acquire information to identify and protect threatened or endangered species and forests of recognized importance when these occur on their property. Although the ATFS program references forests of importance, the language employed suggests flexibility, as landowners are advised to consult related information at the state level. In general, the use of the word “should”, and the lack of stringency within ATFS standard 5, create advisory measures rather than substantive requirements.

Criterion 4 of the Turkish program addresses surveys to determine the presence of endangered species, and requires monitoring of the number of permissions for hunting. The Turkish program is the only one that provides field-based sub-indicators to determine the number of endangered species in forest ecosystems, according to the International Union for Conservation of Nature Red List. The program specifies the range of measurement and potential data sources. Protected forests in the Turkish program are dealt with in a more quantitative manner than in any of the other programs. Again, information on the range of measurement and the variables to assess is provided. Within the Turkish program, Criterion 2 also refers to damage to forests caused by different agents (biotic and abiotic). The program focuses on the area of damage due to a particular factor, but a requirement to assess potential impacts of planned activities (as specified in the FSC program) is not evident within the Turkish program. Although the Turkish program requires the informing of the public about management activities (Indicator N5), there is no reference to a formal process for public consultation.

Under Criterion 1 of the Bulgarian program, an impact/compatibility assessment of planned management activities is required. However, it lacks specific language on which elements to include, and leaves the forest manager to interpret the regulatory requirements. Under Criterion 2, the management of waste is required but only in a general scope, emphasizing inorganic waste. Impacts on endangered and threatened species and vulnerable forest ecosystems are alluded to under Criterion 4 of the Bulgarian program, which also requires the development of measures to protect endangered, threatened or vulnerable species, and other representative ecosystems. The assessment of this elements shall be included in the forest management planning.

The FSC program requires the establishment of riparian management zones, to protect their habitat and function. The program suggests that the extent of the zones should go beyond the habitat to be protected, and the use of regional and local guidelines and scientific information available would determine the dimensions. Buffer widths for stream management zones are based on geographic region, and ground slopes are specified in an appendix of the FSC program. To protect water resources, the FSC program generally requires landowners to operate beyond the scope of forestry best management practices (BMPs), which may have been developed to reduce nonpoint source pollution generated by forest management activities [54]. Nonetheless, the program notes that non-compliance with BMPs does not necessarily mean a nonconformance with the indicator. This could be interpreted as a flexible requirement, but the FSC program further prescribes on-the-ground action to be addressed. In addition, region-specific limitations and conditions for minimizing soil and water disturbance are noted. Objective 3 in the SFI program addresses the protection of riparian zones and other water resources. As with other SFI objectives, this is also plan-based (e.g., “program to implement ... BMPs ...”, “... plans to manage and protect rivers ...” etc.). The SFI program emphasizes adherence to BMPs, yet requires meeting and exceeding the requirements of any other pertinent law or regulation. The protection of water bodies is also considered under ATFS Standard 4. The ATFS program focuses on compliance with BMPs, and specifically mentions riparian zones and wetlands. The protection of water resources is detailed within the Turkish program indicators under Criterion 5. Although the protection of riparian forests is not specific, it requires forest managers to collect

data for river and stream-side afforestation. However, this program is different from the other four in that the sub-indicators require field-based evidence, with the purpose of illustrating which forest areas are managed for the conservation of water. These areas are classified in four types, and are to be reported annually along with the information of at least the previous 10 years. Soil and water protection are contemplated in the Bulgarian program under Criterion 2. In comparison to the other programs, this program does not provide a similar level of information in regard to the protection of water resources. As with the SFI program, the Bulgarian program emphasizes developing plans or documenting information about planned activities to maintain the protective functions of forests (soil and water). However, the relevant documents are not detailed in the program.

With respect to the use of pesticides for forest management purposes, the FSC program is more restrictive on what chemicals are allowed. The FSC, the SFI and the Bulgarian program specifically prohibit the use of Type 1 and Type 2 (World Health Organization) and chlorinated hydrocarbon pesticides. However, the SFI program allows these where there is no other viable alternative. Written strategies that justify the use of chemical pesticides and a specific prescription are only required under the FSC program. The FSC program also requires compliance with its list of highly hazardous pesticides, while the SFI program prohibits the use of pesticides banned under the Stockholm Convention. The ATFS program requires pesticides to be approved, applied, stored and disposed of in accordance with the U.S. Environmental Protection Agency, but the level of detail is not comparable with what is described in the FSC program. The ATFS program states that pesticide application is allowed when other control measures for unwanted plant species are deemed ineffective or impractical. None of these requirements are noted in the Turkish program, although forest managers are asked to report the area, expenditure, and success percentage of chemical control. Finally, the Bulgarian program mandates landowners to provide information about the use of any chemicals in forests in compliance with existing Bulgarian and European Union regulatory framework.

Integrated pest management is encouraged in the FSC, SFI and ATFS programs, but the use of biological control agents is specifically limited only under the FSC and Turkish programs as part of a pest management program. The use of exotic species is addressed by both the FSC and the SFI, although the FSC program is more detailed in requiring documentation of their provenance, location and potential impacts. Restrictions about the use of biological agents are neither defined nor described within the SFI program. The management of invasive species in the SFI program appears under Objective 2 and Objectives 11 and 12, but mainly as requirements to participate in programs and efforts that address the issue. The use of biological agents is not mentioned in the ATFS program, while the management of invasive species is approached under the need to promote forest health. In the Turkish program, one standard briefly addresses the issue of exotic species (non-native or introduced species in the Turkish program) under Criterion 4. The Bulgarian program allows the use of non-local or introduced tree species as long as negative impacts on diversity can be avoided or minimized. Genetically Modified Organisms (GMOs) are prohibited under the FSC and the Bulgarian programs (Criterion 4). In contrast, the SFI program supports participation in research programs and efforts related to the use of GMOs. The use of GMOs is not mentioned in the ATFS or Turkish programs.

With respect to this area of concern, the FSC program is broader in scope and is more substantive than the other four certification programs, which maintain a procedural policy approach. One particular difference is evident in the Turkish program, which takes a field-based approach to documenting potential environmental impacts.

### *3.7. Principle 7: Management Plan*

Except the Turkish program, all programs studied here explicitly require landowners to write and implement a forest plan as a core element of forest certification. These programs use the word “shall”, which we interpreted as a mandatory element. The FSC program is detailed and prescriptive in requiring certain elements to be incorporated into the forest plan, and dedicates Principle 7 to describing the specifics pertaining to this requirement. The FSC program notes that the existence of a

management plan is important, and that the document should be made available to the public. Of the other programs, only the Bulgarian program suggests the latter aspect. This FSC principle concerning a management plan corresponds to Objective 1 of the SFI program. While the SFI program centers its discussion on maintaining long-term harvest levels, it uses less stringent language to refer to the biodiversity, conservation and social aspects of a plan. Other components of forest plans that are required in the FSC program, but are not specifically stated in the SFI program, include the monitoring component, the history of land use and past management, the description of the legal status of the forest unit, the transportation network, consultation processes, and the requirement of qualified professionals to implement the plan.

This FSC principle also corresponds to Standard 1 in the ATFS program, and although the ATFS program does not include all of the mandatory elements noted in the FSC program, those included are well described. The ATFS program tends to focus a forest management plan's design on ecological elements and supports the adaptive management approach. The ATFS program only requires a description and evaluation of individual elements (e.g., biomass, carbon, desired species, wetland, fire, etc.) when these are relevant to the property and consistent with the owner's objectives. Within the Turkish program, Criterion 1 indicates that areas managed under forest plans need to be monitored, so the development of a plan is assumed even though little other language that refers to a plan is provided. Despite the lack of clarity on this aspect, all forested areas in the country are covered by a forest management plan that was developed by the government or a private firm. The General Directorate of Forestry is responsible for the 2140 forest units across the country, and every unit has a forest management plan that is updated every 10 years according to regulations. The Bulgarian program indicates that a forest plan is the guiding document for forest management, and the requirement for developing a forest management plan appears under Criterion 1. The Bulgarian program also notes that a plan should cover at least 10 years, and suggests that no more than 10 years should pass before subsequent updates. As components of a management plan, a forest inventory, the management objectives, maps of resources, and an impact assessment are all mandatory. Although it is mentioned that public interests should be taken into account, the Bulgarian program does not require specific evidence of a process conducted for this purpose, other than making existing forest planning information publicly available.

An up-to-date inventory to inform a management plan is required across the five programs. However, the ATFS program only uses the term once, and without any other detail. The Turkish program, on the other hand, goes further than the other four programs by providing examples of tables to be used for inventorying diverse landscape elements features, such as bird species and fragmented forest area. With respect to this aspect of analysis, the FSC program is again the most detailed of the five programs with a mixed policy approach, while the other four certification programs are largely procedural.

### *3.8. Principle 8: Monitoring and Assessment*

The monitoring and assessment of various management activities is required within the FSC program. The program also alludes to this throughout other parts of the standard (e.g., annual monitoring of high conservation value forests). Although monitoring and assessment are not specifically noted as objectives within the SFI program, the program requires the monitoring of water quality and the protection of water bodies, and BMP implementation, utilization and progress in implementing management activities. Similarly, the ATFS program does not have a specific requirement regarding this principle, yet the ATFS program broadly requires the monitoring of any changes that could obstruct the achievement of the management objectives. Within the Turkish program, monitoring only appears under Criterion 2 in relation to soil resources, and under Criterion 4 in relation to biodiversity. However, it is also implied in an assessment of tree growth and tree damage. A monitoring and assessment plan is not specifically required under the Bulgarian program, but it mentions that the results of monitoring are part of the information to make publicly available. Although there are no



quantitative thresholds specified in the FSC program for this area of concern, it is the most substantive of the five programs, as none of the other programs list this process specifically, and none include as many aspects as does the FSC program.

### 3.9. Principle 9: Maintenance of High Conservation Value Forests

The FSC program notes that the maintenance of high conservation values is an imperative part of the forest planning process. The reconsideration and adjustment of management activities that could impact high conservation value areas is required. This principle is very detailed within the FSC program, but less so within the other programs. High conservation value forests are comparable to the “forests with exceptional conservation value” noted in the SFI program, wherein program participants need to collect information, develop a program to locate and protect these areas, and support conservation efforts concerning these areas. However, public consultation during the assessment and management of these areas is not a requirement (as it is within the FSC program), nor is the monitoring of these areas. Under ATFS Standard 5, forest landowners need to identify and take appropriate measures to protect forests of recognized importance, but the indicators are not very specific. Criterion 4 of the Turkish program addresses some of the elements required in the FSC program for these areas. However, there are no measures noted to ensure the maintenance of these areas. Under Criterion 4 of the Bulgarian program, the requirement to include important forest biotopes and representative ecosystems into a forest management plan is noted, in addition to a clear statement that degradation and change within these areas is not justified.

With regard to this area of concern, the FSC program presents a substantive policy approach, and a broader scope of this requirement. Meanwhile, the SFI, ATFS and Bulgarian certification programs are more procedural in regard to policy style. The Turkish program implicitly suggests a procedural approach, though the indicators under this principle are field-based.

### 3.10. Principle 10: Plantation Management

Of the five certification programs, the FSC is the only one that has a plantation management section, which suggests that plantations shall not interfere with any conservation and protection management objectives, nor with any natural processes. Areas converted to plantations after 1994 are generally not eligible for certification, unless a forest owner demonstrates that they were not directly or indirectly responsible for such conversion [55]. Although the conversion of natural forests to plantations is generally prohibited under the FSC program, there are three conditions that allow the conversion, and FSC provides some definitions and examples of what would be considered conversion of forest land (e.g., for road construction). Within this indicator, the threshold for conversion is less than 2% of the certified forest area. An indicator also suggests the need to develop a compensatory management plan to address the potential negative impacts caused by the conversion. The question of FSC certification of non-native tree plantations is controversial, given the assumed incompatibility of plantations with many of the conservation goals in the program [56,57]. The FSC program represents a substantive policy approach for this area of concern. There is no specific language concerning the development of plantations in the SFI, ATFS, Turkish or Bulgarian programs. The Bulgarian program only states that a change in the purpose of managed forests is allowed if needed, and if the change follows the terms of the program (Criterion 4, Section 4.8).

## 4. Discussion and Conclusions

The main differences between the forest certification programs analyzed here primarily occur at the level and scale of measurable impact, rather than regarding language employed. Perhaps differences in the degree of prescriptiveness could help evaluate the control these certification programs have on forest management. For example, recommendations for specific impact thresholds and other field-based audits make the FSC program stand out from the SFI, ATFS, the Turkish and the Bulgarian programs. The detail and the substance of the FSC program as documented in this analysis could

indicate a positive impact towards sustainable forest management, although other studies have concluded that the FSC (and the SFI) program may fail to adequately address several ecological issues (e.g., [31]). Certainly, additional and updated studies may be needed to verify any of these statements, as well as to evaluate, among others, the public (dis)satisfaction with any existing forest management practices under a certification body, and the impact of the FSC program, with its broader scope regarding local environmental quality and socio-economic well-being. Nonetheless, our analysis benefits both the public and private sectors, whose interest in becoming certified by one or more of the certification programs presented here has been increasing in recent years. The analysis highlights distinct approaches to improving forest practices, including differences in wording and in the level of prescriptiveness these programs use to demonstrate a commitment to sustainability. Similarly, our results emphasize the treatment given to a single environmental element by different programs in order to assess the success of an indicator and the performance of a program in general. For instance, we noted, as in [31], the importance of obtaining measurable field data to assess the impacts of implementing particular indicators such as “maintenance of biodiversity”, but in other cases, written protocols, reviews or oral warnings can serve as the measure of success.

The FSC certification standard for sustainable forest management is the most extensive of all the programs examined. As noted by [42], we found through our analysis that the policy scope of the FSC program is broader, as it includes labor, indigenous rights, and a wide range of environmental rules while in the cases of the SFI and ATFS programs, the scope appeared to be limited to forest management rules and the allowance of flexibility for continual improvement, which in the second case would primarily be required and implemented in the forest management plans. The Turkish and Bulgarian programs also appeared to fall into the narrow policy scope. In the first case, the Turkish program focuses generally on field-based indicators, and provides very little guidance in regard to terms for the applicability of the standard for data collection in general. It is difficult to conclude whether this approach (in sum) might be considered procedural or substantive, because there are no established thresholds for management outcomes. The Bulgarian program contains language much like that employed in the SFI program, which suggests that the approach of the program is procedural and goal-oriented. As with other programs, few specific management outcomes are noted in the Bulgarian program.

The Turkish program applies to nearly all forests in Turkey, which are owned and managed by the government. The standard developed for Turkey encompasses numerous quantitative indicators that reference numbers or areas of features. Unlike the other four programs, the Turkish program presents a series of descriptive and qualitative indicators that relate mainly to the existence of policies and institutional capacity for sustainable forest management. Within the program, these are listed at the end of the document, but we learned that the qualitative indicators included five general indicators and, in theory, one additional indicator under each criterion [39]. This procedure differs from the other four programs, which often contain a single criterion to assess compliance with existing national, international, state and local law, and regulations relevant to the management of forest resources. We also find that within the FSC program, some terms could be confusing when they refer to applying a regulation “when necessary”. The use of such language can leave an issue open to interpretation, and may lead to unnecessary disputes between landowners (or land managers) and other stakeholders.

We recognize that the use of specific terms within the different forest certification programs might be a product of either language differences, potential errors in the translation to English, or simply based on national convention. Local conditions and characteristics could also influence what aspects are emphasized and considered in each program. Further, the structure of the forest sector in the countries where these national certification standards are developed and implemented, the public policy approach to sustainable forest management, and economic factors (e.g., forest product exports and gross domestic product) all could support forest certification initiatives or stifle them [13,58]. In this sense, it is important to mention that even though both the Turkish and the Bulgarian certification programs are new (established in 2019), these countries have worked on establishing partnerships

with international organizations in order to promote sustainable forestry and to provide incentives to address the supply and demand for products obtained from certified forests [59].

Many requirements of the FSC program were lacking or minimally taken into account in the other programs that we considered. There are multiple reasons why these five programs differ, both in the way they are written and how they are implemented. Further, metrics for monitoring progress toward sustainability may differ based on the social, economic and political context within which they are measured [60]. Some countries may also lack the technology for data collection or assessment and monitoring (e.g., geographic information systems), a situation that may make the transition to sustainable forestry slow [28], and forest certification is not well established in developing countries. The potential participants in the programs are also different (FSC: nearly any organization; SFI: any organization in North America; ATFS: private landowners in the United States; Turkish program: government-managed forests in Turkey; and Bulgarian program: all landowners in Bulgaria). The programs analyzed appear to be designed to address the needs and concerns of their target audience, whether they are environmental groups, non-governmental organizations or the industry and private forest land owners. Further, inadequate policies, ineffective legal and administrative tools, and the inefficient administration of programs can limit the implementation and enforcement success of forest certification programs [28,61]. Perhaps these were in the minds of the people who developed the certification standards, criteria and indicators, which may have unknowingly triggered the high levels of mistrust and polarization that exist between supporters of the different forest certification programs, as expressed by [61]. We found it interesting that although we used the most current available documents, some topics of global importance had not been fully considered (e.g., climate change) in the programs studied. These and other considerations are helpful in understanding why some countries develop and implement certification programs, and why public and private landowners in other countries might enter into certification programs, to demonstrate their commitment to sustainable forestry. For example, under the FSC program, the monitoring and assessment of management activities is considered an integral component of certification, but we did not find this requirement to be as fundamental within the other programs. Although we recognize that the ATFS program is very specific to small private forest landowners, additional clarity in terms of demonstrating compliance with the standard might be provided. For example, terminologies such as “good-faith effort” and “landowners are advised to” may be too permissive for the purposes of sustainable forest management. Any needed improvements of the certification programs analyzed here would depend on the performance of each program in each country, when the specific requirements, criteria and indicators are assessed to determine if they are being met and if they are advancing forest sustainability. An important issue that needs to be studied in the future corresponds to a deeper understanding of the cultural variables that have direct effects on the policy process [62]. The diverse definitions and interpretations of sustainability may be another factor that results in a forest certification program appearing more rigorous (substantial) or flexible (procedural).

Political differences between countries, and the cultural context in which programs are developed and implemented, are not always apparent [62]. It is understandable that our results may reflect the specificities of each program, the environmental, social and economic issues they seek to mitigate, the cultural spaces in which they were developed, or some combination of all the above [62]. This study could be complemented by additional analyses, to determine the extent to which these certification programs exceed other requirements set in federal and state environmental law and regulations. For example, is an FSC program threshold for a riparian buffer more restrictive than a government requirement? Or would a plan-based approach be more effective in strengthening the whole ecosystem? It might be relevant for future studies to consider other existent complementary documents, such as definitions, guidance or procedures, and rules that accompany the forest certification programs.

Finally, a comparative analysis of national forestry law and regulations in each of the countries, and the potential influence of them on the development and implementation of forest certification programs, can provide deeper insights into the origin of the differences exposed in this study. It is

possible that certain terms or more detailed information about compliance measures might be found in the laws and regulations that are assumed to be applicable to all potential certificate holders. In the United States, the laws related to forestry vary by owner type and by the geographic location of the forest. Therefore, it is understandable that a single certification program (FSC, SFI, ATFS) for all possible combinations of owners and locations would need to be flexible in many regards, and would need to incorporate more detail that was not already included in other over-arching laws and regulations. In Turkey and Bulgaria, the policy environment is more encompassing of all forests, regardless of owner or location, and therefore some aspects of forest certification would likely already be treated by national laws and regulations, and would not necessarily need to be included in the national forest certification program. Some of these issues were evident in our analysis, yet an open area for investigation seems to involve the deeper linkage between national (or sub-national) legislation and forest certification languages.

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## Appendix A

**Table A1.** Sustainable Forestry Initiative (2015) principles used in the comparison.

1	Forest management planning
2	Forest health and productivity
3	Protection and maintenance of water resources
4	Conservation of biological diversity
5	Management of visual quality and recreational benefits
6	Protection of special sites
7	Efficient use of fiber resources
8	Recognize and respect indigenous peoples' rights
9	Legal and regulatory compliance
10	Forestry research, science and technology
11	Training and education
12	Community involvement and landowner outreach
13	Public land management responsibilities
14	Communications and public reporting
15	Management review and continual improvement

**Table A2.** American Tree Farm System (2019) standards used in the comparison.

1	Commitment to practicing sustainable forestry
2	Compliance with laws
3	Reforestation and afforestation
4	Air, water and soil protection
5	Fish, wildlife, biodiversity and forest health
6	Forest aesthetics
7	Protect special sites
8	Forest product harvest and other activities

**Table A3.** Turkish standards (General Directorate of Forestry 2019) used in the comparison.

1	Forest resources and their contribution to global carbon cycle
2	Health, vitality and integrity of forests
3	Production capacity and functions of forests
4	Forest biodiversity
5	Protective functions of forests
6	Socio-economic functions of forest
<i>Qualitative and Descriptive Indicators</i>	
N1	National forest programs or equivalents
N2	Institutional framework
N3	Legal and regulatory framework
N4	Instruments of finance and economy
N5	Information and communication
N6	Policies, institutions and instruments to sustain and improve forest resources and their contribution to the global carbon cycle in an appropriate way
N7	Policies, institutions and instruments to maintain the health, vitality and integrity of forest ecosystems
N8	Policies, institutions and instruments to maintain and promote the productive functions of forests
N9	Policies, institutions and instruments to sustain, protect and properly increase biodiversity in forest ecosystems
NA	Policies, institutions and instruments in forest management to maintain and properly improve the protective functions of forests
NB	Policies, institutions and instruments to maintain socioeconomic functions of forests

**Table A4.** Bulgarian standards (Council for Sustainable Forest Management and Certification in Bulgaria 2019b) used in the comparison.

1	Maintenance of capacity of the forest resources and their contribution to global carbon cycles
2	Maintaining the vitality, health and protective functions of forest ecosystems
3	Maintenance and promotion of productive functions of forests
4	Maintenance, protection and possible improvement of biological diversity in forest ecosystems
5	Applicable international, national and local legislation and forest management
6	Maintenance of socio-economic conditions and functions of forests

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