SWST accreditation: Shaping the future of wood science and technology education and its role in the forest products industry

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Abstract: Society of Wood Science and Technology (SWST) accreditation plays a crucial role in ensuring that wood science and technology programs remain relevant, industry-aligned, and future-ready. As the forest products sector evolves with shifting global markets and growing sustainability demands, the need for highly skilled professionals in areas like bio-based materials and advanced manufacturing is critical. SWST accreditation establishes rigorous standards, equipping graduates with the technical and professional skills necessary to thrive in the industry. However, awareness of accreditation's full potential remains limited, and many programs could better leverage it to enhance curriculum, strengthen industry connections, and boost global recognition. This paper provides an overview of SWST accreditation and its role in shaping the future of wood science and technology education by maintaining program quality, fostering interdisciplinary approaches, and supporting the development of a workforce that drives innovation and competitiveness within the forest products industry.

Keywords: SWST accreditation; Accreditation standards; Wood science education; Internationalization; Forest products industry.

Introduction

The Society of Wood Science and Technology (SWST) is an international professional society dedicated to advancing the knowledge and profession of wood science and technology and related disciplines. SWST began exploring a potential role in accreditation of wood science programs in the late 1970s (Armstrong and Shmulsky 2008), and accreditation of educational programs has been an important function of SWST, with the first Wood Science and Technology undergraduate program at North Carolina State University accredited in 1984 (VL Herian, personal communication, December 2025; Rice 2010). SWST seeks to enhance the quality of education at the Bachelor of Science and Master of Science levels by ensuring that graduates are exposed to relevant and current topics in wood science and technology. SWST also recognizes that multiple terms (Table 1) may be used to describe a universal concept or program name that benefits its mission and helps develop consensus among accredited programs and constituencies.

Wood science and technology programs have experienced significant evolution over recent decades. Many programs have changed traditional names like "wood science and technology" or "forest products" to more contemporary titles like "bioproducts," "renewable materials," or "sustainable construction management and engineering" (Armstrong et al. 2013), as well as "wood innovation for sustainability." These changes reflect a broader trend in higher education to adapt to evolving industry needs and student interests.

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Table 1. Recognized terminology in wood science and technology for accredited programs (SWST 2025).

Terminology
• Wood Science and Technology
• Forest Products
• Lignocellulosic Materials
• Renewable Materials
• Sustainable Materials
• Bio-based Materials

This paper provides an overview of SWST accreditation, its standards and procedures, its role in shaping the future of wood science and technology education, and its impact on the forest products industry.

History and evolution of SWST accreditation

SWST started developing accreditation guidelines and standards in the 1960s (Rice 2012). The original standards covered most of the topic areas specified by institutional accrediting bodies. It began accrediting university-based, undergraduate-level wood science and technology programs in 1984. Early evaluations of wood science and technology education emphasized accreditation as the appropriate mechanism for strengthening academic programs. A broad survey of North American wood science programs reported strong support for accreditation as a means to enhance program quality, visibility, and institutional leverage, while licensing of wood technologists was viewed as inappropriate for the discipline. These findings reinforced the role of professional societies such as SWST in safeguarding educational standards, particularly at the undergraduate level (Barnes 1979).

At the same time, early commentary cautioned against rapid adoption of highly formalized accreditation models. Drawing on extensive experience with Society of American Foresters (SAF) accreditation, Kaufert (1979) highlighted the financial and administrative burdens associated with national accreditation systems and questioned their immediate feasibility for SWST. These concerns contributed to a cautious, evolutionary approach to accreditation, emphasizing program review and gradual standards development rather than rigid prescriptive requirements.

Until recently, only programs in North America were considered for accreditation, but SWST expanded to programs outside the region with the accreditation of a program at the University of Bio Bio in Chile in 2009. Since that time, programs have received accreditation in Indonesia, China, and Mexico. There were, and remain, professional standards that are detailed, prescriptive, and narrow in scope. In the early 2000s, SWST began a major revision of its accreditation standards aimed at shifting from course-based requirements to outcomes-based assessment, aligned with parallel reforms by SAF and regional higher-education accreditors, while preserving independent, discipline-specific standards (SWST 2001).

Subsequent assessments of wood science education programs reinforced the need for accreditation and continuous program evaluation. Despite increasing interdisciplinarity and curricular diversification, consensus remained that core competencies in wood anatomy, physical and mechanical properties, and processing technologies constitute the foundation of wood science education. These findings underscored the importance of discipline-specific accreditation frameworks capable of accommodating program diversity, while preserving essential scientific rigor (Gardner et al. 2005).

In the past decade, there have been several publications on the status of wood science and technology education and on the need for SWST accreditation to address the changes through revising its guidelines. Table 2 summarizes the publications that address these issues.

As wood science programs broadened to encompass bio-products, sustainability, and renewable materials, concerns emerged that highly prescriptive accreditation standards no longer reflected the diversity of contemporary curricula. Calls to reframe and modernize wood science education emphasize flexibility, international relevance, and outcomes-based evaluation, while retaining a clearly defined disciplinary core. These perspectives further justified SWST's shift toward outcomes-based accreditation as a mechanism for supporting innovation without diluting disciplinary identity (Shupe 2011).

Advantages and impacts of SWST accreditation

Wood science and technology evolved from formal forestry education systems into a recognized interdisciplinary scientific discipline with wood physics as its core, supported by over a century of dedicated research institutions and international collaboration (Sandberg and Niemz 2025). This historical and scientific foundation underpins the need for rigorous, discipline-specific accreditation of undergraduate wood science programs.

Society of Wood Science and Technology accreditation provides numerous benefits for educational institutions, students, and

Table 2. Status and changes in wood science and technology education and SWST accreditation.

Main Points	Authors
Challenges and opportunities facing wood science programs in the United States, particularly the need to adapt to changing student interests and industry needs and rebranding the discipline to highlight its relevance to sustainability, environmental issues, and the bioeconomy.	Smith and Valverde (2019)
The challenge of low enrolment in Wood Science and Technology (WST) programs, and various strategies to address the challenge.	Armstrong et al. (2013)
SWST should change responding to the evolving needs of its members and the broader society. It should pursue initiatives which include enhancing student membership and developing educational material for accredited programs.	Cloutier (2012)
Evolution and refocusing of accreditation standards for programs and disciplines, particularly within the Society of Wood Science and Technology (SWST).	Rice (2012)
Broadening SWST accreditation guidelines to meet the evolving demands of the wood products industry to include renewable or sustainable materials, green building materials, environmental and ecological concerns, renewable materials processing, physical properties of renewable materials, bioenergy, bioenergy systems, and business and entrepreneurship.	Rice (2010)

the forest products industry, globally. In addition to publishing peer-reviewed literature, SWST archival records document the development and operationalization of its accreditation system. Accreditation Committee reports published in newsletters describe formal multi-year program reviews, site visits, joint evaluations with SAF, the transition toward outcomes-based assessment, standards revision through public consultation, and the SWST Executive Board oversight, providing primary evidence of the rigor and continuous improvement embedded in SWST accreditation.

Accreditation enhances the reputation of wood science and technology programs, signaling to prospective students, employers, and the public that the program meets high standards of quality and relevance. This can lead to increased student enrollment; increased quality of graduates; improved faculty recruitment; increased exposure and potential for collaboration with peer institutions, industry and government research organizations; and greater recognition of the program's achievements.

It should be noted that SWST accreditation is discipline-specific and does not replace licensure-based or national engineering accreditation systems. While its visibility may not be extensive outside the wood science community, this reflects a focused, outcome-based evaluation against wood science and technology standards. Unlike prescriptive engineering accreditation schemes, SWST accreditation emphasizes disciplinary coherence, scientific foundations, industry relevance, sustainability, and continuous improvement. This focus makes it particularly well-suited to academic programs in which wood science forms the central intellectual and professional foundation.

As for student outcomes, SWST accreditation enhances the employability of graduates by ensuring programs provide them with the knowledge, skills, and credentials that employers seek. Accredited programs ensure that students are well-prepared for careers in the forest products industry and related fields and professional networks. These opportunities can enhance their educational experiences, broaden their horizons, and connect them with potential employers. In terms of industry impacts, SWST accreditation streamlines workforce training by ensuring that graduates possess the necessary skills and knowledge for the forest products industry. This reduces the extent of necessary on-the-job training and allows employers to hire graduates that are more workforce ready. Accredited programs produce graduates who are equipped to drive innovation, develop new technologies, and contribute to the growth and sustainability of the forest products industry.

Finally, SWST accreditation plays a crucial role in promoting sustainable practices in the forest products industry globally. SWST-accredited programs incorporate principles of sustainable forestry into the curriculum, educating students about responsible forest management, conservation, and biodiversity. The standard encourages coverage of development topics such as life-cycle assessment, a tool used to evaluate the environmental impact of products and processes throughout their entire life cycle. Similarly, circular economy is a topic being

embraced by programs in their course coverage, emphasizing to students the topics of waste reduction, reuse, and recycling in the forest products industry.

SWST accreditation aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 9 (industry, innovation, and infrastructure), SDG 12 (responsible consumption and production), and SDG 15 (life on land) (United Nations General Assembly 2015). It helps ensure that curricula include aspects of the SDGs so that graduates can contribute to achieving those goals. By promoting sustainable practices, accredited programs contribute to global sustainability efforts.

Accreditation standards, procedures, and guidelines

SWST independently evaluates programs that choose to undergo the accreditation process. The evaluation process is flexible to accommodate recognition of professional bachelor's degrees, bachelor's degrees, and master's degrees and how these degrees can vary based on program characteristics and requirements, country, etc. The three objectives of these evaluations are: (1) improve the quality of education through self-assessment and external review; (2) recognize global institutions that meet or exceed minimum requirements set by SWST; and (3) promote and encourage coverage of knowledge essential for practicing scientists and technologists (SWST 2025). Accreditation assessment ensures that the environment, facilities, faculty, and infrastructure are sufficient for a program to produce competent graduates with a firm grasp of the tenets of materials science and technology and with a well-rounded education. The core of an SWST-accredited program requires inclusion of a fundamental understanding of renewable materials as well as basic materials science, including raw materials biology, physical properties, mechanical properties, and chemical characteristics and properties. It is also suggested that the program covers other materials and includes properties of these materials in their basic materials science coursework. Table 3 outlines several key areas in which students in an accredited program may focus. The standard requires students to develop a foundation in at least one of these areas (SWST 2025).

The essential components of SWST-accredited programs include a rationale and purpose, as well as goals and objectives to achieve its mission; educational objectives that are consistent with the institution's mission and SWST accreditation standards; a process for establishing educational objectives that responds to the needs of program constituencies; and an evaluation process that measures performance based on the SWST accreditation standards and uses the results to improve the effectiveness of the program.

In terms of the procedures for the accreditation to take place, a renewable materials program may request review for initial accreditation by SWST when it has operated a professional bachelor's, bachelor's, or master's program meeting SWST criteria for at least five years. Comprehensive self-study and self-evaluation are essential first steps in the accreditation process. The goal of the self-evaluation is to demonstrate compliance with SWST accreditation standards, determine accountability, and form the basis for program planning and improvement. To be valuable, a self-evaluation must be candid, realistic, and assesses all aspects of the program(s) under review. An annual report is required from each accredited program, which includes a summary of important changes and accomplishments that have occurred during the past year.

Table 3. Key areas in which students must build foundational knowledge (SWST 2025).

	Topic Areas	Description
1.	Harvesting, processing and manufacturing of renewable materials	Processing renewable materials from harvest into valuable products.
2.	Environmental impacts, assessment and sustainability	Covers life cycle analysis, carbon storage, certification, safety, standards, and legal issues.
3.	Bioenergy and bioconversion	Processing renewable materials is energy-intensive but offers efficiency gains. Understanding energy delivery, environmental impacts, life cycle analysis, and policies is essential.
4.	Business and entrepreneurship	Covers business, finance, marketing, and entrepreneurship in renewable materials.
5.	Growth and management of renewable materials (e.g., forestry/forest sciences)	Managing renewable materials for sustainability while meeting societal needs.
6.	Sustainable building materials and construction methods and management	Explores renewable construction materials, their impact on daily life, business, health, and the environment.
7.	Renewable materials science and engineering	Deepens science and engineering knowledge for graduate studies or research careers.
8.	Pulp, paper and packaging sciences	Pulp, paper, and packaging studies cover processes, sustainability, and engineering for industry operations.

The role of SWST accreditation in the forest products industry

SWST accreditation plays a significant role in ensuring the competence and readiness of graduates entering the forest products industry (Rice 2010). By setting standards for curriculum and competencies, SWST ensures that graduates possess a firm grasp of materials science and technology and a well-rounded education. Accreditation helps to improve the quality of professional education in wood science and technology through self-assessment and external review. Accreditation also recognizes institutions that meet or exceed minimum requirements set by SWST. Accreditation standards define a profession and provide accountability to those standards and promote competency among the graduates of those programs (SWST 2025).

SWST accreditation standards can incorporate needs assessments to identify gaps in innovation capacities and skills within the forest sector. Innovation is crucial for tackling global challenges and achieving SDGs within the forest sector, as emphasized in the "State of the World's Forests 2024" report of the UN Food and Agriculture Organization (FAO 2024). This provides a strong rationale for the importance of high-quality wood science and technology education that can foster such innovation. Global wood production is at record levels, approximately 4 billion m^3 per year. Projections indicate significant increases in wood demand by 2050 (FAO 2024). These data points underscore the need for a skilled workforce to manage forest resources and production sustainably, which can be enhanced through SWST accreditation.

The world forest sector has developed unequally across regions, with North America and Europe leading in the forestry value chain. Developed countries have achieved higher production efficiency through advanced technologies, enabling them to create more income with fewer jobs, compared to developing countries (Li et al. 2019). This suggests that wood science and technology education should be tailored to regional needs and focus on improving production efficiency and value addition in developing economies.

Ultimately, accreditation is a signal to employers that graduates from a program possess foundational knowledge of wood as a material, a knowledge base lacking from graduates of almost any other program. While employees with other backgrounds learn about wood through on-the-job experience, their lack of foundational wood science and wood technology knowledge limits their effectiveness in problem solving when faced with the idiosyncrasies and complexities of wood as a material.

Internationalization of SWST accreditation

The Society of Wood Science and Technology strives to uphold its vision of becoming the world leader in advancing the profession of wood science. Its initial focus on only North America has now become global in nature (Armstrong 2014). SWST is poised to expand its global reach. As of February 2025, there were a total of 12 SWST accredited programs worldwide (Table 4). China is an important country with three accredited programs and one undergoing evaluation in 2025. There are seven accredited programs in the United States and one in Mexico. Accreditation is active for the duration of 10 years, with re-accreditation required at that time. A yearly update report is required of all programs to maintain accreditation.

SWST accreditation standards are comparable to regional frameworks, such as the European Higher Education Area,

Table 4. SWST accredited programs worldwide.

Program reviewed	Country	Initial accreditation	Most recent	Expires
North Carolina State University, Raleigh	USA	1984	2015	2025
Virginia Polytechnic Institute and State University, Blacksburg	USA	1985	2015	2025
Mississippi State University, Starkville	USA	1987	2023	2034
West Virginia University, Morgantown	USA	1989	2019	2029
Oregon State University, Corvallis	USA	1990	2023	2024
University of Maine, Orono	USA	1993	2013	2024
University of Idaho, Moscow	USA	1996	2015	2025
Nanjing Forestry University, Nanjing, Jiangsu	China	2017	2017	2027
Zhejiang A & F University, Lin'an, Hangzhou	China	2018	2018	2028
South China Agricultural University, Guangzhou	China	2019	2019	2029
Inner Mongolia University, Hohhot, Inner Mongolia	China	2024	2024	2034
University of Guadalajara, Guadalajara*	Mexico	2024	2024	2034

* Accredited MS degree only

ensuring that accredited programs meet international benchmarks for quality and relevance. Additionally, SWST accreditation plays a role in reducing skill gaps across emerging and developed economies by providing a standardized framework for wood science and technology education. This ensures that graduates possess the skills and knowledge needed to contribute to the global forest products industry.

Lessons learned from SWST accreditation reviews

This section presents a synthesis of accreditation visit reports, offering insights into how these evaluations are shaping educational practices and fostering stronger connections with the forest products industry. The following reflects observations from site visits to five programs (three in the U.S., two outside U.S.) that were accredited during 2023–2024. It is important to note that these observations should be interpreted in context. The accreditation visits involved different accreditation teams, institutions with varying missions, resources, and institutional policies, and programs operating within distinct national, regulatory, and cultural contexts. As such, the observations are not intended for direct comparison or generalization, but rather to provide illustrative insights into recurring themes and experiences encountered during recent accreditation activities.

The accreditation journey begins with an extensive self-study, where institutions document their strengths, challenges, and strategic visions in aligning with SWST standards. This preparatory phase includes data collection, stakeholder engagement and pre-visit readiness. This foundational work sets the stage for on-site evaluations, which are crucial for validating self-reported data and offering real-time feedback. During the accreditation visit, evaluation panels conduct detailed tours of facilities and research laboratories, observe live demonstrations of teaching practice, and hold interviews with key stakeholders. Evaluation panels use a set of well-defined SWST criteria to systematically assess institutional performance. This dual focus on recognition and constructive feedback underscores the accreditation process as both an evaluative tool and a roadmap for continuous improvement.

Table 5 is a summary of general strengths and areas for improvement among SWST-accredited programs, based on evaluation data collected from December 2023 to December 2024. A checkmark (✓) indicates that the respective strength or improvement area was identified during the program's self-assessment, site visit, or peer review process. The "Total (✓)" column represents the number of programs reporting each item.

SWST accreditation reviews across various institutions have revealed both shared strengths and recurring challenges that can serve as valuable guidance for prospective or developing programs. Among the most notable strengths are strong stakeholder relationships, where programs typically maintain close ties with partners, alumni, and government bodies. This results in robust internship pipelines, collaborative research opportunities, and enhanced student employability. Another strength lies in the provision of adequate resources and facilities, including up-to-date laboratories and dedicated spaces for hands-on learning. Additionally, faculty members are typically described as dedicated, collaborative, and committed to student success, forming a strong backbone for academic quality.

Table 5. Summary of general strengths and areas for improvement of SWST accredited programs during the period of December 2023 to December 2024.

Strengths	U.S. 1	U.S. 2	U.S. 3	Non-U.S. 1	Non-U.S. 2	Total (✓)
Strong stakeholder relationships	✓	✓	✓	✓	✗	4
Adequate resources and facilities	✓	✓	✗	✓	✗	3
Dedicated and collaborative faculty	✓	✓	✓	✗	✗	3
Areas for improvement	**U.S. 1**	**U.S. 2**	**U.S. 3**	**Non-U.S. 1**	**Non-U.S. 2**	**Total (✓)**
Low enrollment numbers	✓	✓	✓	✓	✗	4
Need for recruiting strategies	✓	✓	✗	✓	✗	3
Curriculum enhancement	✓	✓	✓	✗	✗	3
Faculty development and diversity	✓	✗	✗	✗	✗	1
Administrative and program support	✗	✓	✗	✓	✗	2
Assessment and evaluation	✓	✗	✗	✗	✗	1
Facilities	✗	✗	✗	✗	✓	1

(✓) = the respective strength or improvement area was identified during the program's self-assessment, site visit, or peer review process. "Total (✓)" column represents the number of programs exhibiting each item.

However, several key areas for improvement emerge. Low enrollment remains a common concern, often driven by limited public awareness of the discipline. While accreditation alone does not directly increase enrollment, SWST accreditation can serve as a strategic asset for programs seeking to enhance visibility and student recruitment. Accreditation provides an externally validated mark of quality that can be leveraged in institutional marketing, industry engagement, and students advising to differentiate wood science programs from broader or less specialized offerings. In addition, alignment with SWST standards can strengthen industry partnerships, internship pipelines, and graduate employability narratives, which are increasingly important factors influencing student enrollment decisions. Programs are encouraged to invest in targeted outreach and digital engagement strategies. Curriculum modernization is another pressing need, with calls to better integrate emerging topics such as circular economy principles, digital fabrication, and renewable materials innovation. Faculty development and diversity are also flagged as critical areas, requiring support for professional growth and inclusive hiring practices.

Administrative limitations, including understaffing and communication gaps, can hinder program efficiency and growth. Strengthening internal communication channels and clarifying staff roles can mitigate these issues. Lastly, a consistent need for improved assessment practices has been noted, underscoring the importance of clear learning outcomes, robust data collection, and continuous quality enhancement.

By understanding and proactively addressing these lessons from past accreditation reviews, new and existing programs in wood science and renewable materials can position themselves for long-term success and impactful contributions to the field.

Prospective programs in wood science and renewable materials can thrive by proactively addressing these common challenges. Leveraging strengths such as stakeholder partnerships and faculty dedication, while planning strategically around enrollment, curriculum, and program infrastructure, will position new or evolving programs for long-term success and meaningful impact.

Future trends

SWST accreditation ensures the relevance and future-readiness of wood science and technology education by addressing contemporary issues such as sustainable development, bioeconomy, and technological advancements. As sustainability and bioeconomy gain importance, there is a growing demand for professionals skilled in materials science, industrial ecology, markets, biomaterials, bioenergy, regulatory policies, green building materials, and business management (Rice 2010). Programs are evolving to incorporate biomaterials, bioproducts, green materials, and biosystems engineering, while addressing environmental and ecological concerns. Recognizing wood's key role in bioeconomy, SWST has highlighted its significance in the building sector, which has one of the highest ecological footprints and the greatest potential for reducing climate impacts.

As for technological advancements, Industry 4.0 and the emerging Industry 5.0 technologies provide significant potential in the wood sector to extract relevant information and improve the management of the entire supply chain (Weiss et al. 2021). These optimization technologies are applied to material science such as wood-based materials, including wood modification, real-time monitoring of wood properties, and defect detection using sensor-based monitoring. The use of technology can optimize sawing and production processes (Molinaro and Orzes 2022). Furthermore, the integration of augmented reality in the harvesting process can help optimize the harvesting process and improve efficiency.

When adapting to changing demands, SWST accreditation standards will continue to require a fundamental understanding of wood as a material. SWST changed its guidelines in 2005 to what is termed "outcomes-based" assessment for programs. Under this approach, the program being accredited must show "demonstrated competencies" in specific areas. The challenges cited have resulted in several programs in the United States revamping their curricula (Rice 2010). A 2023 change to the standard allowed accreditation of MS-level programs, with the University of Guadalajara being the first to achieve MS degree accreditation. This change was partially motivated by a focus on the multiple MS programs across Europe. Accordingly, greater efforts will be placed on identifying potential institutions across Europe, and globally, with MS programs focused on wood.

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