

Forest Values: A Framework for Old-Growth Forest with Implications for Other Forest Conditions

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Abstract: Old-growth forests (OGF) in North America have declined significantly since European colonization. Many conflicts about basic values over OGF harvesting have occurred in recent decades. Understanding these values is an important component of addressing such situations. This paper is based on two studies of OGF values, which captured the range of existing values and the nuances that define them. Moyer conducted a narrative study with six leaders in Canada's forest sector. Owen conducted a series of nine one-day field workshops which included 76 participants representing citizen constituency groups in Nova Scotia. Insight gained from these two studies was used to build upon existing forest values typologies to construct a forest values framework with some unique features. The framework provides opportunities for immediate use and future research.

INTRODUCTION

Forest cover, old and young, continues to decline worldwide [1]. Old-growth forests (OGF) in North America have declined significantly since European colonization as trees were cut for timber and forests were burned for agricultural and settlement purposes [2]. Several criteria and definitions have been used to describe OGFs. Some use a process-based scientific definition [3], while others refer to specific physical characteristics such as the prevalence of old trees, fallen decomposing logs, standing dead trees (snags), canopy gaps, areas of undisturbed soil, the variety and quantity of lichens or growth layers, and the lack of human disturbances [2].

In the last decade, estimates of OGF extent in the Maritime provinces of Canada [New Brunswick (NB), Nova Scotia (NS), and Prince Edward Island (PEI)] ranged from 0 to 4%, similar to that of the Boreal forests of Northern Europe [4-8]. In contrast, around 55% of the temperate coastal rainforest on the Pacific coast of British Columbia is believed to be in the old-growth stage [9].

While the west coast of North America has a more abundant supply of OGF compared to other regions, the forests are being steadily harvested. Many conflicts over OGF harvesting have occurred in recent decades, most notably the Spotted Owl controversy in Washington and Oregon which pitted timber interests against those in favour of protected areas for the endangered Spotted Owl [10] and the protests in Clayoquot Sound, British Columbia [11, 12]. OGF-related conflicts have also occurred in other regions; significant examples include blockades and protests near Temagami, Ontario [13, 14], over the Main River watershed of Newfoundland [15, 16], and over Kaiser Meadows in NS [17]. Many factors contribute to these situations, including conflicts among basic values.

Forest Values

Values are important in environmental decision-making because they drive players' interests and positions and play an influential role in determining people's actions [18-20]. Two value categories described by Rokeach [21] include held values (modes of conduct {ex. respect}, ethical principles {ex. equity} or end states {ex. beauty}) and assigned values (the relative worth of an object, thus describing a preference relationship {ex. commercial value}).

These two value types are interrelated in that *assigned* values usually reflect a person's *held* values [22]. Values, once acquired, become part of an organized values system. The value hierarchy within a system is used to resolve conflicts and make decisions [21]. Individuals and groups may have similar values, but the priority given to different values within the system can result in ideological differences [20]. As such, values are fundamental to many environmental and forestry conflicts [23-25].

Many common techniques for studying values rely on economic theory and have proved inadequate for encompassing the range and complexity of values. While the monetary quantification of values facilitates their inclusion in cost-benefit-type analyses, the process can introduce many sources of bias [26, 27], and cannot fully capture the ethical and emotional motivations which often lie at the heart of people's value systems [28-31].

Public participation theory, suggests that involving citizens in decision-making creates a democratic skilled, literate, and empowered population which builds a credible political system and democratic nation [32]. Beyond democratic ideals, involving the public can create better decisions as local information and broader perspectives can lead to more effective problem solving [33]. Specific justification for public participation in forest decision-making includes: incorporating local knowledge and values [34], providing processes for discussing and resolving conflicts [35], creating greater commitment to decisions

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[36], and matching shifting public forest values with government management policies and practices [37].

Keeney’s [38] work on value-focused thinking contributed to the development of multiple criteria techniques that operationalize values information into the creation of management alternatives. Keeney [38] defined values as an ideal or a principle (a held value), rather than a value of worth (an assigned value). In value-focused thinking, the first step is to decide what is wanted (the value or the end-states). The second step defines the paths to get there (the alternatives). Held values can be measured on a continuum of being fulfilled, or be traded off of one value against the other.

Despite the benefits that incorporating values into decision-making processes can bring, until recently they have been largely excluded from the forest-management process because management was often viewed by both managers and foresters primarily as a timber-focused enterprise [39]. The degradation of forest health, conflict over OGF, and

demands for non-timber forest values [40] influenced the Canadian forest-management establishment of the early 1990s to take a broader view, encompassed in sustainable forest management (SFM) principles. A key tenet of SFM is the incorporation of multiple constituency values.

Specific studies on OGF values are fairly sparse, particularly in Canada, though there are a number of forest value typologies outlined in the literature. Twelve forest values typologies including the works of Rolston and Coufal [41], Bengston and Xu [42], Manning *et al.* [43], were compared (Table 1) with the values identified in our studies. These frameworks illustrate some patterns within valuation systems, but provide little information on possible value differences related to old versus younger forests. In addition, there is no common expression of what certain values mean and how they should be expressed (i.e. held values or assigned values). This paper combines data from two OGF values studies [44, 45] to build on existing literature to define a for-

Table 1. Forest Values Typologies

Forest Values Categories	Anthropocentric [48]			Bio-centric [48]						
	Material [43]	Instrumental [22, 42]	Ecosystem Protection [49]	Non-Material [43]	Non-Instrumental [22, 42]	Amenity [49]				
Forest Values	ecological/ environment [22, 43, 50, 29, 31, 51]	economic [41, 41, 43, 25, 29, 31, 49]	Recreation [41, 22, 43, 48, 25, 29, 31, 49, 51]	aesthetic [41, 22, 42, 43, 50, 25, 29, 31, 49, 51]	cultural [22, 43, 50, 25, 29, 31, 51]	intrinsic [21, 22, 48, 25, 29]	spiritual [41, 22, 42, 43, 50, 25, 29, 31]	therapeutic [43, 25]	scientific [41] [22] [43], [29] [51]	respect & admiration [48]
	life support/ sustaining [41, 42, 25, 30]	employment [29, 49]		artistic [31]	future generations [22, 48, 25, 29, 49]	moral/ ethical [42, 43, 29, 51]	rejuvenated [48, 49]	health [50]	education/ learning [22] [50] [25] [49] [51]	recovery ability [29]
	wildlife, fish, plants [41, 22, 48, 49]	products [48, 49]			community [29, 51]		close to nature [48]	lifestyle [50]	psychological [22]	
	biotic diversity [41, 25, 29]	timber [48, 49]			historical [43, 25]		peace and well being [48]	psychological [22]	intellectual [43] [50] [29]	
	endangered species [22, 49]	wasted if not used [22, 48]			natural history [41, 29]		philosophical [29]	religious [29]	creative [29]	
	clean water [49]	fisheries [22]			cultural symbols [29]		religious [29]	religious [29]	place identification [29]	
	complexity [29]	livestock [49]			oppositional forces [29]		sacred [48]	sacred [48]		
	ecosystem services [22]	oil & gas [48]			population sustainability [29]		solitude [22]	solitude [22]		
	natural systems preserved [22]	pharmacy [29]								
	old-growth [22]	tourism [22, 49]								
	subsistence [25]	utilitarian [42]								
	watersheds [22]									
	wilderness [29]									

Notes. Values categories and values/value statements in the table correlate with references. Values were grouped in similar theme areas.

est values framework that is reflective of OGF values and includes a comprehensive suite of categorized held forest values.

MATERIALS AND METHODS

Moyer [44] conducted a narrative study with six leaders in Canada’s forest sector. Leaders in the forest sector were defined as individuals who have contributed in a significant way to forest and OGF management and policy through involvement in industry, government, academics, activism or publication. The group of participants was selected to exhibit a variety of perspectives and to yield a rich data set. Selection criteria included participants’ expertise with forestry and OGF, their representation of diverse roles and interests within the forest sector, and their geographic location within Canada (Table 2).

The study was based primarily on a series of three 45- to 90-minute interviews with each participant, conducted in person. Participants were asked to share stories and reflections about their context and background, their activities in the forest sector, and the values which have informed and given meaning to these activities. The narrative component of the data analysis involved the creation of a personal profile for each participant. The data were also coded for patterns and themes using NVivo™ software, facilitating synthesis of the data from the six participants. Significant values were identified by both the frequency and the intensity with which they were articulated, and the rich narrative data provided insights into the nature and meaning of the values expressed.

Owen [45] conducted a series of nine one-day field workshops with citizen constituency groups in Nova Scotia. Participants were purposively selected to represent five citizen constituencies identified in the literature as groups whose values should be taken into consideration in forest decision-making [46, 47]. These included Aboriginal groups, environmental non-government organizations, forestry professionals, and the urban and rural publics. Participants were recruited through organizations representative of the constituency groups, newspaper advertisements, and posters. Seventy-six participants were involved (Table 3).

Participants were introduced to a number of definitions used to describe old-growth. In the context of the stands visited, old-growth was defined using the Nova Scotia Department of Natural Resources [52] definition of 120 plus years. During the field trips, each participant was given a diary to record personal thoughts during visits to young (40-60 years), mature (80-120 years) and old-growth (120 years plus) cut and uncut forest stands in the morning. In each diary, factual information on each forest stand visited was provided along with in-stand photos, and a few prompting questions that related to the research questions. The diaries followed an open-question format allowing participants to write down values and events in their own words.

In the afternoon, a group discussion and rating sheet were used to elicit additional information. Seven focus group questions were posed during discussions (Fig. 1). Group responses were recorded on flip chart paper and digital recorder. The rating sheet was accompanied by definitions of all the old-growth values identified in the literature and silvicultural treatments. The rating sheet was nestled in towards

Table 2. Participants in Moyer’s [44] Study

Participant	Role (s)	Region	Gender
George Van Dusen	industry forester	Newfoundland	Male
Jim Drescher	woodlot owner, public educator	Nova Scotia	Male
Peter Schleifenbaum	landowner, forester	Ontario	male
Peggy Smith	Aboriginal, academic, forester	Ontario	female
Hamish Kimmins	Academic, forester	British Columbia	male
Vicky Husband	environmental activist	British Columbia	female

Note: Participants consented to have their identities revealed when they agreed to take part in the project.

Table 3. Participant Characteristics and Numbers in Owen’s [45] study

Age	Constituency											
	Ab. (Mi’kmaw)		Env.		For.		Rur.		Urb.		Total	
	Fem	Male	Fem	Male	Fem	Male	Fem	Male	Fem	Male	Fem	Male
<25		2	1			6		1	5	1	6	10
26-44	4	1	2	1		6	5	3	1	4	12	15
45-60		1	2	1		3	7	4	2	4	11	13
60+			1	1		1	2	2	2		5	4
Total	4	4	6	3	0	16	14	10	10	9	34	42

Note. “Ab.” = Aboriginal, “Env.”=Environment, “For.” = Forestry, “Rur.” = Rural, “Urb.” = Urban.

the end of the focus-group session to allow time for individual reflection before the focus-group session was complete.

1. Of what value is old-growth?
2. Of what value is younger growth?
3. Is there a difference between the two?
4. How did you feel when you saw the partially cut stands vs. the uncut stands?
5. How do you feel about using silviculture to hasten the arrival of old-growth conditions?
6. If you had the chance to advise an "owner" of a forested area that has old-growth or has the potential for old-growth what would you say?
7. Is there anything you came wanting to say that you didn't get a chance?

Fig. (1). Seven focus group questions.

All the information from the diaries, including demographic information, initial impressions, views on the six stands, and final impressions, was typed and saved as text files. Focus group flipchart notes were transcribed to text files along with the corresponding digital files. All text files were analyzed using N6™ (formerly NUD*IST™), a qualitative research software program, which was used to code information into theme areas. Rating sheet data were entered and analyzed using Excel.

Both Owen and Moyer used Bengston and Xu's [42], forest values framework as an initial typology. A values definition sheet was used to standardize values definitions for consistent meaning. The researchers analyzed data separately and then worked together to combine findings to build upon existing forest values typologies.

RESULTS

Over a hundred values were articulated by citizen constituency groups and forest leaders in interviews, diaries, and focus groups as objects (medicine), processes (recreation), and end states (water quality) [44, 45]. Similar to existing literature on forest values (Table 1), our data show that participants value OGF for environmental services, economic, material, and aesthetic, spiritual, cultural, and ethical experiences.

Even though some values associated with young forests were also used to describe OGF, they were used in a different context and/or with a different intensity. For example, in younger stands, values were focused on the "abundance" and "types" of biodiversity and habitats. In old growth, the valuation focused on unique species, genetic, and structural elements of biodiversity and habitat [45]. Values relating to history, heritage, future generations, sacredness (spiritual connection), and peace, were referenced more often and with more intensity with respect to OGF [44, 45]. In addition, references were made to the importance of subsistence values such as medicines, berries, and living trees as opposed to timber for shelter. Economic values were rated for both young and old growth, though the type of economic values identified for old growth have arguably lower-impact uses. Landscape values such as eco-tourism, low-impact recrea-

tion, and non-timber forest products were cited by a number of participants as economic use values for old-growth forests. Only a few participants cited the value of old-growth trees for timber [45] (Table 4).

To reflect the breadth of the data, we felt it was important to have a comprehensive values framework with consistent terminology that was inclusive of different cultures and forest types. We chose Bengston and Xu's typology [42] as a starting point because the general categories are sound and distinguish between distinct ways in which forests are valued. In this system, the two main categories of values and subsequent sub-category values are expressed as held values. These include instrumental (economic/utilitarian and life-support) and non-instrumental (aesthetic and moral/spiritual) values. Furthermore, the use of held values makes the system flexible and functional. It is inclusive of a broad range of value types, it allows different characteristics, uses, and processes to fit into more than one value category, and it is abstract enough to accommodate values that may not be entirely understood, such as life support.

Our forest values framework (Fig. 2) begins with the same primary categories that Bengston and Xu used. In essence, these categories reflect the two distinct types of values expressed by our participants, but we have elected to replace Bengston and Xu's terms (instrumental and non-instrumental) with the terms "**Material**" and "**Nonmaterial**" values, which are also noted by Manning *et al.* [43]. "**Material**" describes a tangible product or service. "**Nonmaterial**" refers to an understanding, concept, experience, or belief that is valuable to the mind or soul. These terms better describe the values within the categories and the manner in which the values were held by our participants, which was not a straight instrumental-non-instrumental dichotomy. For example, some material components of the forest were not valued solely for their utility in fulfilling human ends. Environmental services, such as carbon storage and water purification, for instance, were valued for the necessary functions they provide for both humans and other living beings.

Similarly, many nonmaterial values revealed an instrumental element in their expression. Participants described their attachment to these aspects of OGF with intense emotion and deep personal investment. This suggests that rather than being valued entirely as ends in themselves, nonmaterial values simply serve a different kind of end than do material values. The material- nonmaterial designation also avoids the controversy over the existence of objective non-instrumental, or intrinsic, values in nature noted by Bengston and Xu [42].

At the level of the sub-categories, we have made more significant changes, adding several new categories, revising definitions, and attempting to provide a comprehensive set of held values under each category. These changes and additions were made by comparing our data to the values framework and dictionary developed by Bengston and Xu [42], and to other forest values literature (Table 1), and by identifying inconsistencies and absences. Two new sub-categories were created under Nonmaterial values to reflect the abundance and specificity of nonmaterial values expressed by our participants. Furthermore, a comprehensive list of held values associated with each sub-category has been provided.

Table 4. Value Difference Between Younger Growth and Old Growth

Study	General/Younger Forest Values	OGF Values
<p>In Moyer's interviews, values or objects of value were elicited through questions about what was valued most highly about these forest conditions or what should be the primary goal of management.</p>	<ul style="list-style-type: none"> • Carbon sink • Diversity • Ecological processes • Environmental services • Timber/wood products • Water • Aesthetic • Cultural values • Goods and services • Insight/perspective 	<ul style="list-style-type: none"> • Biodiversity • Benchmark/reference point • Ecological processes • Insight/perspective • Life • Age • Carbon sink • Environmental services • Ethical • Naturalness/undisturbed • Non-fibre • The people who live in the forest • Public education • Recreation • Wildlife
<p>In Owen's study, participants provided values information on younger forests and OGF in their diaries, on a rating sheet, and in focus group sessions.</p>	<p>Examples include:</p> <ul style="list-style-type: none"> • Habitat • Biodiversity • Oxygen production, • Economic [i.e. timber, forests products, hunting and fishing] • Water quality and quantity • Education/research • Recreation • Intrinsic value • Beauty • Naturalness <p>There were more material values ascribed to younger forests than to old growth.</p>	<p>All values associated with younger forests were also attributed to OGF but often in a different context or with a different intensity (priority). For example:</p> <ul style="list-style-type: none"> • (Unique) habitat and biodiversity • Beauty (very) • Sacredness (spiritual connection) <p>As well, additional key values were used primarily to describe old-growth forests. Examples include:</p> <ul style="list-style-type: none"> • Heritage • Peace • Generational sharing • Protection • Personal renewal and reflection • Eco-tourism • Medicine • Carbon sequestration. <p>For example out of 32 respondents who wrote about a spiritual connection to the forest in their diary, 88% of participants referred to this connection with old growth as opposed to younger growth. Thirty respondents identified the value of untouched forest stand, with a sense of place away from the disturbances of humans. This primeval, untouched feeling was noted 95% of the time in old growth.</p>

Examples of objects (eg. timber), processes (eg. recreation), and characteristics of these held values are also noted.

Material Values

Economic Values: The definition for Economic values and for related held values has been shifted to include both market-based and subsistence economic activities. The economic value of forests and OGF is often considered solely in terms of employment and contributions that timber-related forest industries provide to the market economy and to government coffers. While the value of jobs and timber revenues were recognized by our participants, it was clear that economic activity in the forest is conducted on a much broader spectrum, particularly amongst Aboriginal peoples. To encompass this cultural diversity, we listed categories such as **products**, which can include both timber (and consequently jobs and market benefits) and medicine or berries, which might be used by the gatherer or sold. Berries could also be

placed in the **food** category, while timber can also be considered as a **shelter** value. At the same time, shelter could refer to a large canopy of trees in a culture that does not use lumber. **Credits** refer to economic exchanges for ecosystem services, and **landscapes** involve the material components of recreation and tourism.

Life-Support Values: The definition of Life-Support values was reworked to include the benefits that forest functions and services provide for both humans and non-human species. The values in this category generally encompass the importance of the natural cycles and web of life that exist within all stages of forest succession. The valuation of these qualities is magnified with respect to OGF (as opposed to other stages of the forest cycle) because OGF is perceived to be more natural and less disturbed than other forest conditions and therefore these cycles and systems exist in a state of greater integrity [44]. The ecological processes and cycles in question include contributions to **air quality**, **carbon**

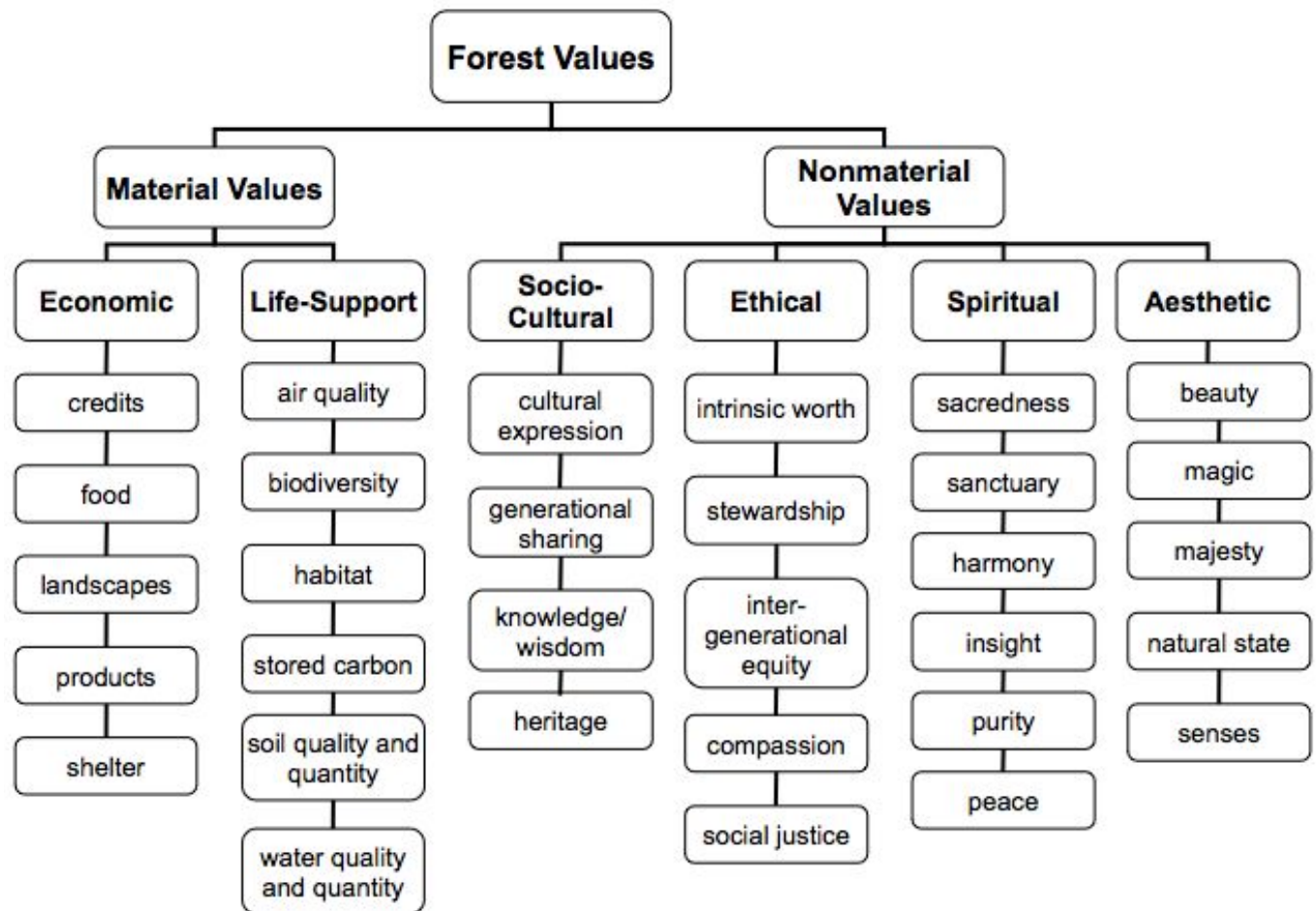


Fig. (2). Forest values framework.

storage, and soil and water quality and quantity [45]. There was a recognition amongst participants that these processes are priceless in their value because they provide services which humans could not possibly engineer themselves [44].

The particular physical characteristics that are associated with different OGF conditions, such as large trees and an abundance of dead wood, also provide **habitat** for species that may depend on OGF for their survival, and that contribute to **biodiversity**. Diversity was defined in numerous ways, including species diversity, genetic diversity, and structural diversity. While there was some disagreement over the degree to which OGF holds more biodiversity in all available categories than other forest conditions, the consensus that some form of biodiversity was a highly valuable quality of OGF was widely accepted [44].

Nonmaterial Values

Socio-Cultural Values: Bengston and Xu's [42] classification system lacked a category for social and cultural values, which concern human interactions with each other through the forest. These types of values were articulated in great detail by our participants, and were rated as a value that was in many cases exclusively related to old growth. Certain constituency groups, especially Aboriginal participants, emphasized above others such cultural values as **heritage**, **generational sharing** and **cultural expression** through activi-

ties including building canoes and collecting medicinal plants [44, 45]. Participants also stressed the importance of OGF to gaining **knowledge and wisdom**. In particular, foresters identified the key contribution that OGFs make to research as benchmarks or reference points, allowing researchers to measure the effects that human activities and forest management approaches are having on other forests [44].

Ethical Values: We created a separate category for ethical values, detaching it from Bengston and Xu's Moral/Spiritual category. While ethical and spiritual values are closely related and mutually influential, they exhibit significant distinctions. Ethical values tend to be based on principles and philosophy, and may be quite abstract, though they can also have a profound emotional component. For example, values such as **stewardship**, **inter-generational equity**, **social justice** and **compassion** were derived from principles about the proper treatment and manner of relating to other people and beings, both in the present and in the future [44, 45].

Though we intentionally avoided the concept of non-instrumentality or **intrinsic worth** as a primary category, it is included at this level because our data revealed that some people do value OGF simply for being OGF [44, 45]. Keeping with the spirit of our participants' responses, we are avoiding the problems associated with the concept of objective intrinsic value by adopting a subjectivist approach to

defining intrinsic value. Human beings are able to identify with and connect to non-human entities, both emotionally and rationally, and through this process, may include these entities in their realm of moral consideration and recognize their inherent value [22].

Spiritual Values: Spiritual values differ from ethical values in their experiential component. Many spiritual values were expressed in direct association with a specific forest visit or site. It seems that some kind of sensory or experiential connection, whether it be a memory of one's own experience, a description of someone else's, or even pictures, are necessary for the spiritual experience to occur and for the related spiritual value to exist. This is another category of values which many participants identified as being greater with respect to OGF than other forest conditions.

The lack of human disturbance and the particular characteristics of certain types of OGF seem to create a powerfully spiritual environment. Participants spoke of experiencing a lifting of the soul **sacredness**, of feeling tranquility and solitude **peace** and **sanctuary** [44, 45], of feeling a lack of separation between themselves and the forest **harmony**, of turning outside themselves and gaining perspective **insight** [44], and being in a primeval untouched place of **purity** away from human disturbance [45].

Aesthetic Values: **Beauty** and texture were key aesthetic values identified with old growth [45]. In defining and listing such Aesthetic values, we tried to recognize their subjectivity and personal nature. This departs from Bengston and Xu's [42] more rational approach, in which they present aesthetic value as something that is based on objective judgement, asserting that only an informed and discriminating observer can perceive it. This does not correspond with the manner in which our participants discussed the aesthetic values of OGF. Assessments of the pristine or **natural state** of OGFs tended to be based more on a feeling than on objective, rational inquiry. The **sensory** experiences that people valued were highly personal, and the valuation of beauty, **magic** and **majesty** derived from personal reactions of awe and wonder to the physical experience of the forest. Most of Moyer's [44] participants asserted that assessments of beauty or ugliness are a matter of individual taste (i.e. beauty is in the eye of the beholder) and some also seemed consciously to separate the scientific or objective part of their mind from the part of their mind that appreciates beauty. It should also be noted that some participants expressed the opinion that OGF is not always as beautiful as other stages of forest development, describing OGF as messy, chaotic and in decay [44]. Most participants in Owen's study [45] preferred uncut old growth stands to younger stands for aesthetic and spiritual reasons.

In summary, our forest values framework exhibits several unique key features. There are three levels of OGF values consistently defined as held values, and objects, processes and characteristics that express these values can fit into more than one category. Also, a broader set of distinct nonmaterial values is defined. Finally, it is more reflective of subsistence economies and the life-support values associated with non-human species (Table 5).

DISCUSSION AND CONCLUSIONS

Our forest values framework adds new data and structure to existing forest values research. Its unique OGF perspective is reflected in the detail and abundance of nonmaterial values. When compared with values associated with forests in general, OGFs are valued more for their contributions to unique knowledge and biodiversity, their beauty, their spiritual components, and their cultural links [44, 45]. In contrast, the valuation of other forest conditions seems to place more emphasis on material, and particularly economic values [44]. These findings have implications for SFM decision-making as they highlight the uniqueness and importance of values associated with old forest compared with other forest conditions. Generic forest-values frameworks and decision-making processes may not be specific enough to deal with these differences. Therefore, a framework specific to the breadth of forest values is presented herein.

In the initial presentation of his forest values classification system, Bengston [54] emphasized that there are more than just market-based economic values involved in society's relationship to its forests. Our forest values framework builds upon this assertion, and attempts to extend it to encompass an even broader set of values. Our framework also reflects similarities in existing forest typologies such as Rolston and Coufal [45] and provides what we hope is a fairly comprehensive categorization of the types of values that should be considered and explored in research about public forest values. In this process, we have tried to incorporate a broad range of perspectives, including those that do not fit into the traditional worldview of western science and philosophy. Therefore it is our view that the framework may have application in other continents beyond North America. At the same time, the very notion of building such a framework, as well as its form and content, are products of western culture and its approach to managing knowledge.

The forest values framework provides opportunities for immediate use and future research. Planning exercises provide an opportunity to use the framework as a tool to discuss and prioritize values in multi-constituency fora. Each representative can identify priority values and place them in the framework categories. The comparison of priority value categories can be used to discuss criteria and indicators for management options.

The framework can also be used to review OGF policy to ensure that the breadth of nonmaterial and material values is reflected. For example, the Nova Scotia Interim Old Forest Policy, and subsequently the Score Sheet [52], currently focus on life-support value priorities and indicators. A more complete suite of criteria reflective of the breadth of old-growth values could be developed for the Old Forest Policy. A selection of indicators for these criteria could be used in the Score Sheet. One example of a new criterion could be preservation and access to Nova Scotia's natural cultural heritage (socio-cultural value). A possible indicator would be OGF areas of historical importance to Aboriginal peoples and other cultural groups. This indicator provides guidance on type and location of old-growth conservation areas. The summation of existing ecological indicators, along with

Table 5. Forest Values Framework Definitions

Main Value Type	Value Sub-Category	End Value		
		Name	Definition	
Material: values that are instrumental to physical and bodily needs	Economic: tangible material values that support a cash-based or subsistence-based economy	Credits	credits issued for ecosystem services; (processes: bartering, trade); (objects: supplies, money, securities)	
		Food	material that is consumed to capture energy and sustain health; (processes: hunting, fishing, gathering); (objects: wild edibles, deer, moose, salmon)	
		Landscapes	the structure and features of a specific area of land including physical, biological and built elements; (processes: recreation, tourism); (objects: trails, physical and natural amenities)	
		Products	something that is made from raw materials; (processes: logging, value-added); (objects: timber, medicine, furniture, firewood, paper)	
		Shelter	covering that provides protection, particularly from the elements; (processes: construction, thatching); (objects: timber and canopy cover)	
	Life-Support: values that provide necessary functions and services for the survival and well-being of humans and other living beings	Air quality	status of the atmosphere with regard to the existence of potential pollutants; (processes: air purifying, absorption of air pollution)	
		Biodiversity	number, variety, and uniqueness of living organisms, including genetic, species, and ecological diversity; (processes: biological processes, biological systems)	
		Habitat	place where a population of flora, fauna or micro-organisms lives; (processes: habitat protection, habitat loss)	
		Stored carbon	the long-term storage of carbon in the forest (trees or soil) or oceans so that the build-up of carbon dioxide will reduce or slow (processes: carbon sequestration, carbon fixation)	
		Soil quality and quantity	capacity of soil to function within an ecosystem to provide for flora and to maintain and improve water and air quality; (processes: nutrient cycling, retaining moisture)	
		Water quality and quantity	the condition of water with respect to the amount of impurities in it and the amount of it; (processes: water purification, surface run-off, water cycle)	
		Non-material: values that are instrumental to the needs of the mind and soul	Social/ Cultural: values contributing to the identity and well-being of the social collective and the participation of individuals in that collective	Cultural expression
	Generational sharing			people from different generations learning from each other
	Knowledge/ wisdom			the fact or condition of having information, or of being learned; insight and judgement; (processes: education, research) (object: benchmark, reference point)
Heritage	something immaterial, like an ideology, that is passed from one generation to another			
Ethical: values supporting a personal or collective moral claim; include a sense of responsibility to other people, nations, generations, and species	Intrinsic worth		designation of inherent worth and moral relevance through rational or emotional identification with something that is other [22]	
	Stewardship		evoking a sense of trust and care through the conscientious and responsible management of something	
	Inter-generational equity		concern for the rights and needs of future generations	
	Compassion		sympathy for the suffering of other beings and a desire to relieve or prevent that suffering	
	Social justice		concern for the well-being and fair treatment of people and groups of people	
Spiritual Values: values associated with "...the experience of being related to or in touch with an 'other' that transcends one's individual sense of self and gives meaning to one's life at a deeper than intellectual level"[53 p. 25]	Sacredness		experience of, or connection to, that which is holy or divine	
	Sanctuary		a place of refuge and solitude	
	Harmony		the combination of elements that form agreement of feeling	
	Insight		the act or fact of apprehending the inner nature of things or of seeing intuitively	
	Purity		freedom from that which contaminates, defiles or corrupts	
	Peace		a mental or spiritual state marked by calmness of heart and mind; spiritual serenity	
Aesthetic: values based on a sensory appreciation of the physical qualities and features of the forest	Beauty		pleasurable qualities associated with artistry, form, colour, and originality	
	Magic		something that creates an effect of otherworldliness	
	Majesty		large and impressive in size, scope, and/or extent	
	Natural state		existing in or produced by nature; not artificial or an imitation; an undisturbed area	
	Senses		physical sensations such as smell, taste, temperature, vision, and hearing	

economic, aesthetic, socio-cultural, and spiritual indicators, could be used to determine the target for how much OGF to conserve compared to other forest types. Similar opportunities may exist in the policies in other provinces.

The forest values framework also points to promising avenues for further research. Qualitative and quantitative data from over 80 Canadian participants was used to develop this framework. Further research could be done to validate the framework with larger and more diverse populations.

In addition, a fruitful opportunity arises through the recognition of inter-relationships that exist between the levels and among categories within the levels of our framework. While such connections were not specifically the subject of our research, their existence is clear in our data. For example, valuing habitat for the purpose of supporting the life of other species may be linked to ethical convictions about intrinsic worth. Similarly, food collection may be both an economic and a cultural value. Following Bengston and Xu [42], we have built our framework to allow uses and characteristics to fit into more than one category. Further research, however, could provide insight into the specific nature of these inter-connections and they could then be incorporated more explicitly into the conceptual model (Fig. 2).

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