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Development of a framework for understanding unsold timber offerings from the US National Forest System

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Timber sales from the US National Forest System (NFS) can provide ecological and economic benefits. Unsold (“no-bid”) offerings can result in delays, additional costs, and missed targets. We used mixed methods, including analysis of administrative data, synthesis of research, and semi-structured interviews to understand situations considered “no-bid” offerings by different stakeholders. We measured prevalence, identified causes, and generated a framework for communicating interlinkages. From 2007 to 2020, the volume not sold at first offering was 11.9% nationally. However, a substantial amount is sold subsequently, leaving 2.7% never sold. Regions with the highest percentage never sold include Alaska, Southwestern, and Pacific Southwest. A new conceptual framework developed from a literature review and interviews with NFS and industry employees identified proximate causes and underlying factors. Proximate causes include road construction, equipment requirements, and timber condition; whereas underlying factors include staffing, communication, and appraisal methods. These insights can aid communication and help develop future strategies.

Keywords: timber sales; appraisal; public land; forest management

1. Introduction

The US Department of Agriculture (USDA) Forest Service (FS) provides strategic management of the National Forests for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.¹ An important management tool is timber sales, which provide ecological benefits and economic opportunities. Ecologically, well-planned sales can provide wildfire mitigation, wildlife habitat, insect and disease prevention, among others. Economically, timber from National Forests provides raw materials for local businesses, and excess revenue (above costs associated with administration) is transferred to the US Treasury.²

Occasionally, timber sales offered by the FS receive no bids from interested buyers, and go unsold, which are colloquially called “no-bids” within the agency. Sometimes these “no-bids” can be sold at a later date with or without re-advertisement or modifications to the sale terms.² Still, any unsold offering can cause planned management activities to: (1) be delayed, deferred, or lost; (2) require additional time and cost to rework and re-advertise the sale; or (3) miss set timber targets.³ “No-bids”

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have been a recurring issue for the agency over the past 40 years, and a moderate amount of past research has explored related topics (e.g. Brown *et al.* 2012a; Haynes 1983; Klepacka, Siry, and Bettinger 2017). However, relatively few scientific studies have been conducted specifically related to “no-bid” or unsold timber offerings. Those that address the topic specifically often focus on proximate, sale-specific appraisal factors (e.g. Buongiorno and Young 1984; Gebert, Niccolucci, and Schuster 1998; Sendak 1991), and only a handful explore the underlying institutional, policy, market, and other factors that create the conditions for the proximate causes to occur (e.g. Niccolucci 1989a, 1989b; Schuster and Niccolucci 1991).

1.1. Objectives

This manuscript is part of a larger research project to identify, quantify, assess, and evaluate various factors that impact unsold or “no-bid” timber offerings, with a view to informing future actions to reduce them. This manuscript deals with initial research steps aimed at developing a common language and an overall conceptual framework. As with any large organization, communication within the FS can be a challenge. Perspectives, motivations, and use of terminology can vary within the hierarchy and across geographical regions.

These first research steps involved understanding situations that are variously considered “no-bid” by different stakeholders, measuring their prevalence, identifying frequent causes, and generating a framework for communicating their interlinkages. Such information is vital for communication among and between forest planners, forest managers, policymakers, and researchers, and sets the stage for future work. To address this goal, we used a mixed-methods approach.

Specifically, the objectives of these first steps in the project, related in this manuscript, were to:

1. Facilitate the discussion about the type and prevalence of “no-bid” timber offerings
 - a. Define and compare types of “no-bids”
 - b. Calculate the relative frequency of types of “no-bids”
 - c. Explore geographic and time trends for “no-bids”
2. Understand factors that are believed to influence or drive “no-bid” timber offerings
 - a. Identify proximate causes and underlying factors affecting “no-bid” offerings
 - b. Understand how these factors are perceived and interrelated
 - c. Develop a conceptual framework for communication of factors affecting “no-bid” offerings

2. Background

2.1. Timber sale preparation

Timber harvesting is regulated by several statutes. From its origin, the FS was mandated to protect watersheds and “to furnish a continuous supply of timber.”⁴ Later, several other laws broadened the focus of National Forests and required research, planning, and balancing of timber sales with other consumptive and non-consumptive uses.^{1,2,5} Sales go through planning and analysis, ensuring that appraisals are set at fair market value and the sustainability of timber supply and ecosystems are considered.² Other laws seek to limit potential negative environmental impacts by requiring studies and public dissemination, constraining certain activities, and potentially

requiring mitigation measures.^{6,7} These laws and regulations create a complex context for administering timber sales and harvests on National Forest lands and have received scrutiny from environmental groups and lawmakers (Riddle 2021).

Directives surrounding timber sales on National Forests vary by NFS Region (Figure 1), but generally follow a similar path. The planning, design, and layout of these sales go through several stages, known as “gates” (Figure 2). The gate system provides the basic structure for NFS timber sales from design to award and is integral to understanding the various processes and thresholds that need to be met for the success of timber sales (FS 2002).

The appraisal, conducted during Gate 4, is required prior to a sale being offered, since the NFS “may [not sell timber] less than appraised value.”² The appraised value (alternatively called the “advertised rate,” “minimum bid price,” or “reserve price”) therefore is a floor below which no bids can be accepted. Earlier analyses in Gates 1 and 2 help to determine the overall economic feasibility and guide the design and layout in Gate 3. By contrast, the sale-specific appraisal in Gate 4 has objectives which include: estimating a fair market value, encouraging competition, bringing advertised values close to bid values, and maintaining sensitivity to forest product market changes (FS 2022). The Residual Value method, used by Region 10 (Alaska), necessitates gathering local manufacturing cost data. All other FS Regions have used the Transaction Evidence Appraisal (TEA) method for the past 30 years (Haynes, Skog, and Aubuchon 2016). TEA uses “base period prices” (BPPs) from past timber sale transactions. Fair market stumpage value is estimated using various “cost centers” like “stump-to-truck” (skidding), hauling and road maintenance, environmental protection, and road

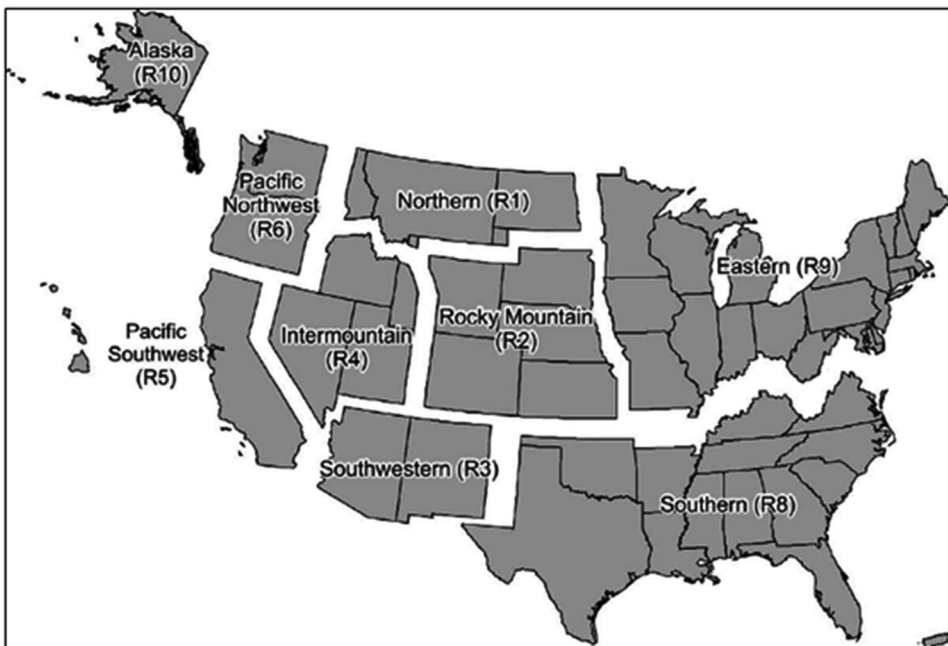


Figure 1. Map of the USDA Forest Service, National Forest System Regions. There are 9 Regions, numbered 1–10, excluding the number 7, which was dissolved into other Regions more than 30 years ago. Source: Heath *et al.* (2011), used with permission.

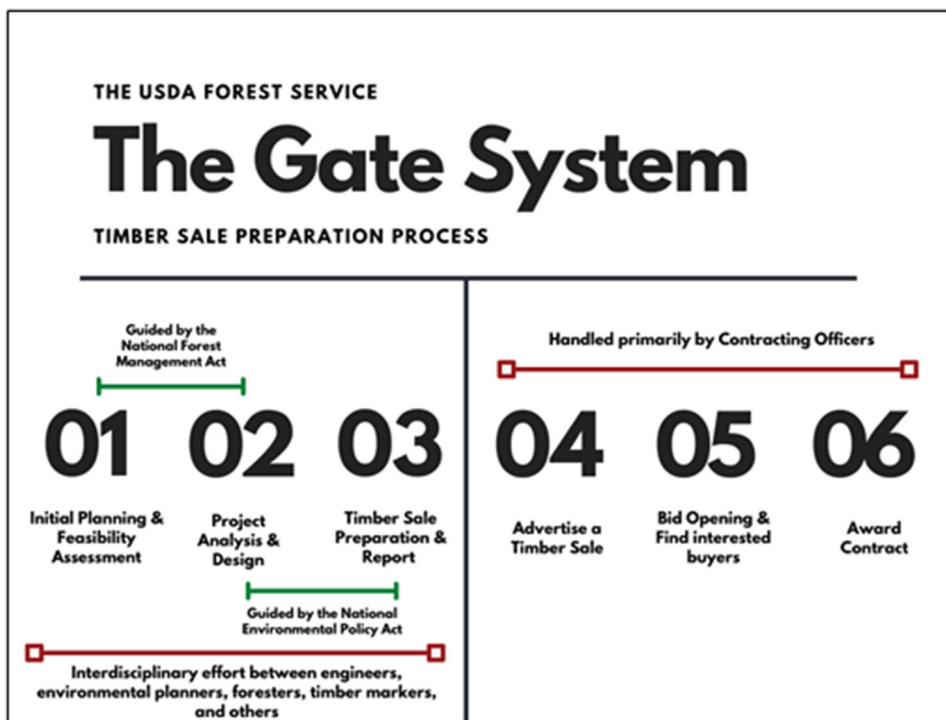


Figure 2. Diagram illustrating the FS “Gate System”, their timber sale preparation process, along with pertinent guidance and staff involvement.

construction (FS 2005). The base period cost for each center is then adjusted up or down for a specific sale “for significant cost or value differences,” such as quality of timber, the cost of transportation, and the cost of development (FS 2002). The resulting stumpage value is then reduced by a “competition” or “rollback” factor, to calculate the final advertised rate. This downward adjustment is intended to capture sufficient competition to establish the fair market value, allow for possible changes or risks in the market, and account for the risk of overstated values or factors not included in the appraisal (FS 2005).

2.2. “No-bid” timber offerings

There are various benefits of a robust timber program, but the success of timber sale proposals depends on the active engagement and bidding of professionals such as timber buyers/procurers from the forest products industry. Discussion of the feasibility and desirability of increasing or decreasing the volume of timber removed from NFS has been a perennial, and at times contentious, topic of discussion (e.g. Bell and Randall 1982). Prior to the 1990s, timber harvest from the NFS could exceed 23.5 million cubic meters (m^3) (10 billion board feet) per year. In the early 1990s, there was a deep plunge in timber sale volume from the NFS due to legal challenges associated with environmental protection laws,⁸ as well as a broader strategic shift away from the production of commodities toward environmental services and amenities (Cortner and Schweitzer 1993; Farnham and Mohai 1995; Luppold and Baumgras 2000). Harvest

levels have generally remained in the 4.2–6.6 million m³ (1.8–2.8 billion board feet) range since 2003 (Riddle 2021), but there is a recent trend toward increased timber targets. The target for 2021 was 9.4 million m³ (4 billion board feet), an 8% increase from the 2020 target (FS 2020).

The amount of “no-bid” offerings varies by Region and year. Adams and Haynes (1991) estimated that unsold timber offerings over the period 1973–86 ranged from 5 to 10% in interior west areas, and 2.5 to 3% in coastal west areas, with trends in the percentage roughly following national forest product markets.⁹ More recently, in 2015–20, unsold offerings had the potential to increase sale volume between 12 and 19%, which would have reached 99% of the target or higher for each year (FS 2021).

3. Methods

The study area included all Regions of the NFS (Figure 1). The nine Regions include 154 National Forests across 40 different states and Puerto Rico, including Forests in virtually all major forested ecoregions in the continental United States. All Regions have a timber sales program, but the volume offered and overall level of activity between and within Regions can vary significantly based on species, management needs, markets, and other factors. National Forests occupy a much larger portion of the forested area in western states (52% in Regions 1–6, 10) than in eastern states (6% in Regions 8–9), owing primarily to the historical pattern of settlement by European-Americans from east to west and the time in which the National Forests were established.

We used a mixed-methods approach to gather information from various available sources, in order to develop language and generate a more concrete understanding of “no-bid” offerings and their causes. These methods included: (1) categorization and summarization of historical timber sales data, (2) review and synthesis of past research, and (3) interviews of NFS personnel and timber industry professionals. These three approaches led us to the development of a conceptual framework for the factors influencing “no-bid” offerings.

3.1. Analysis of historical data

We used historic timber sales data from the FS Timber Information Manager (TIM) System¹⁰ to quantify “no-bid” offerings. We categorized individual offerings, as described in the Results section, below. We conducted basic data summarization and analysis of both the number of offerings and total timber volume of offerings in each category. We explored possible trends in “no-bid” offerings/volume over time (2007–2020) and by NFS Regions (Figure 1).

3.2. Synthesis of past research

We searched for relevant peer-reviewed literature on the factors influencing the likelihood that timber offerings from public lands in the United States will not be sold (will receive no bids) in order to contribute to the interview guide and development of the conceptual framework. While there is a large amount of literature on topics such as timber appraisal methods, auction and sale techniques, economics/costs of logging approaches, and factors related to the supply and demand of timber and lumber, our

goal was not to explore this vast literature, but rather only that which specifically addresses unsold/“no-bid” offerings, particularly in the context of the United States public lands. We searched the Google Scholar database using the term “unsold timber”, resulting in 69 references. These were screened to determine whether they address factors influencing the likelihood of receiving bids, and were relevant for US public lands. This resulted in a limited set of eight references. Subsequently, we reviewed each of the eight manuscripts’ bibliographies to find additional literature and authors. The result was 44 manuscripts related to the topic. The manuscripts were analyzed by identifying specific factors influencing the likelihood of sale, and qualitatively synthesizing additional related information. Of the 44 manuscripts, 22 provided concrete evidence of specific factors influencing the likelihood of sale, and an additional 22 provided support for similar themes in the qualitative synthesis.

3.3. Interviews

We conducted in-depth, semi-structured interviews with NFS employees that spanned all Regions, who have extensive knowledge in various portions of timber sale planning, preparation, and administration, and were actively engaged in handling “no-bid” timber offerings. We sought opinion leaders on the topic of no-bids, with diverse perspectives, that is, from diverse position types and geographic areas. Since the FS has approximately 27,000 full-time employees throughout the country, the vast majority of whom are employed in Regional, Forest, or District offices, researchers used a recommendation-based approach to finding potential interviewees. First, we conducted informal interviews with FS Headquarters (Washington Office) staff who were key stakeholders for this research to better understand the current issues surrounding “no-bid” offerings. We asked them to identify staff in Regions who had been particularly active, were knowledgeable, and had significant experience working with National Forests on timber sales in general and no-bid issues specifically. After receiving recommendations, we filled in missing gaps in position or geographic areas, with key stakeholder consultation, to create a list of potential interviewees. The research team reached out to a total of 27 employees with 19 accepting an interview invitation. Sixteen employees worked in Regional Offices and three worked in Forest-level offices. All nine Regions were represented during the interviews; job titles included Timber Sale Administrator, Contracting Officer, Engineer, Environmental/NEPA Planning, Appraisals, and Timber Program Manager. After listening to a description of the project and how the interviews would be used, interviewees confirmed their consent orally. All interviewees were asked the same set of questions pertaining to their current and past positions, their role in timber sales, what issues they thought were controllable by the FS, and what they thought the issues were regarding “no-bid” timber offerings and how they think the FS can work to reduce those issues. Most interviews lasted around one hour, ranging from approximately 30 to 90 min.

In addition to interviews with NFS personnel, researchers also found it important to gain a perspective from employees of timber-buying companies. Recommendations of interested and engaged industry professionals were solicited from the NFS interviewees. The nine industry professionals interviewed ranged from small-scale family operations to regional mills to large forest product companies. All Regions were represented except for Region 2. Region 1 had two interested industry professionals who wished to be interviewed, one of whom resided near the border of Region 1 and

Region 2, though worked primarily in Region 1. Interviewees orally confirmed informed consent and were asked the same set of questions, mostly detailing their reasons for choosing not to bid on timber sales in the past, and they were then asked to respond to specific factors that were brought up during NFS personnel interviews and their relationship with those factors. Interviews lasted approximately 20–60 min.

Interviews were conducted by phone or online meeting platform and transcribed verbatim. Transcripts were coded and thematically analyzed. For NFS personnel interviews, which were conducted first, transcripts were coded using an inductive approach for emerging themes. Individual responses were categorized to inform the emerging framework focused on understanding the proximate and underlying factors of “no-bid” timber offerings, the level of control employees perceived that the FS had over these causes, and any potential solutions they had identified. For industry interviews, we utilized the framework developed after NFS personnel interviews and coded industry interviews for themes that both fit into that existing framework and those that were not previously mentioned. Individual responses were also coded if they were identified or noted as a potential solution to the reduction of “no-bids”.

The qualitative information from the interviews was the primary outcome, and served to both identify and categorize drivers, as well as to understand the relative importance that NFS and industry professionals place on each. Counting of mentions of each topic was used to provide corroborative and supplementary information (Hannah and Lautsch 2011) related to those outcomes, particularly understanding whether NFS or industry personnel placed more emphasis on a particular topic. Although care should be taken not to place undue importance of the results counting/tabulating mentions of topics from interviews, counting within an established conceptual framework and theoretical underpinning can provide a way to better understand the broad body of the qualitative work (Silverman 2010).

3.4. Development of a conceptual framework

Considerations of preparing, awarding, and implementing timber sales relate to economic factors. In theory, appraisals take into consideration any high costs (road construction, environmental mitigation) or low revenues (poor quality or undesired timber species) within the proposed sale, resulting in a lower minimum bid price. A competitive market theory posits that, since multiple producers compete, no one single player can influence the market (Haynes 1980). If competitive market assumptions were to hold, the bidding decision for each potential buyer would be based strictly on factors related to profitability – revenues, costs, and risks. An offering would be unsold only if the costs were higher or revenue lower than what the appraiser estimates (Niccolucci 1989b). An underlying assumption of such a market would be perfect information, or at least, no large asymmetries in access to information.

In reality, markets and information are imperfect, and the causes of “no-bid” offerings are complex and interrelated. Many Regions lack perfect markets since the NFS may be the largest, or indeed the only major source of timber supply, and there may be only a handful of timber buyers. Furthermore, different players may not have equal access to information. Numerous factors influence decisions in ways that are not directly related to profitability. Thus, the factors related to whether sales receive bids are not easily condensed into an intuitive format.

We utilized a conceptual framework of “proximate causes” and “underlying factors”, which has been used in many fields such as health and medicine, biology, and sociology, and was popularized in socio-economic forestry research by Geist and Lambin’s (2002) work on the drivers of deforestation. In general, proximate causes are the immediate reasons why something occurred, whereas the underlying factors create the conditions that make the proximate causes more likely. Overlaid on the underlying factors, we added the additional concept of levels of control. That is, who has the power to change or manipulate an underlying factor? This overlay helps understand what can potentially be done to influence the underlying factors, and by whom.

In the case of no-bids, proximate causes can be defined as immediate factors that drive an offering to be unsold. That is, what is (are) the concrete reason(s) why a potential buyer, who might have otherwise made a bid, chose not to make a bid? These reasons are likely to be “sale-specific” and highly linked to valuation and appraisal. Specifically, factors that make the true value of the stumpage less than the appraised value. As described above, they are most directly connected to the profitability (revenues, costs, risks) as well as the feasibility (timing) of the sale. Underlying factors are interrelated issues that influence the sale-specific factors. This framework allows for complex and nuanced factors to be highlighted while still providing a way to incorporate all potential influences and allowing that much of this is impacted by regional variations.

4. Results

4.1. Definition and comparison of types of “no-bid” offerings

Early conversations with NFS employees involved in timber sales led to substantial confusion about the meaning of the colloquially-used term “no-bid.” Based on conversations with these key stakeholders, we outlined four key categories of results from timber offerings, three of which could be considered “no-bids” depending on the stakeholder’s context and primary interest:

- Category 1: Timber was offered, but never sold.
- Category 2: Timber was offered, did not receive any bids at the first offering, changes were made to the sale terms (for example, a larger or smaller tract of land was offered), and was subsequently sold.
- Category 3: Timber was offered, did not receive bids, and was then sold later with no changes made to the sale terms.
- Category 4: Timber was sold at the first offer.

Bid categories were determined based on whether an individual bid contract was listed for resale. Offerings that did not have a final bid price were never sold (Category 1). Offerings with a final bid price, listed for resale with a different advertised price than the initial advertised price were classified Category 2. Offerings with a final bid price, listed for resale with the same final advertised price as the initial advertised price were classified Category 3. Offerings with a final bid price and not listed for resale were assumed to have sold (Category 4).

Various stakeholder perspectives correlate with these categories and how they could be grouped to define “no-bids” (Table 1). First, those primarily interested in meeting yearly timber targets would like to see timber sold on the first attempt, and

Table 1. “No-bid” and “sold” definitions depending on stakeholder’s primary interest.

Stakeholder primary interest	Sale result			
	1. Never sold	2. Sold with changes	3. Sold without changes	4. Sold first offer
Meeting targets	No-bid	No-bid	No-bid	Sold
Reducing management costs	No-bid	No-bid	Sold	Sold
Ecological benefits	No-bid	Sold	Sold	Sold

may consider categories 1–3 as “no-bid” offerings, while category 4 would be considered a sale. Re-advertisement often pushes the timeline of sales to future years, thus hindering the success of meeting yearly timber targets. Second, those primarily interested in administration and the cost of changing a sale contract may group categories 1–2 as “no-bid”, and 3–4 as a sale. These stakeholders may want to reduce personnel and costs associated with making revisions, such as re-appraisal. Third, those most interested in land management practices taking place to reduce hazards from natural disaster and enhance habitat management, even if it takes additional time or effort, may consider category 1 as “no-bid” and 2–4 as a sale.

4.2. Relative frequency, geographic and time trends of “no-bid” offerings

Depending on one’s perspective and interests, it may be more important to reduce timber volume unsold, or to reduce the actual number of unsold offerings. This is related to the variation in volume offered by sale. For example, a small timber offering that goes unsold may not impact the yearly volume sold very much, but still require just as much work to reconfigure. So, if someone is interested in meeting a volume target a small sale may be less important than a large sale, but for someone interested in managing the agency personnel and budget, it is just as important.

Figure 3 presents the national yearly NFS timber offering results categories which could be considered “unsold” or “no-bid”, depending on the stakeholder, by percentage of volume offered, for the period 2007–20 (fiscal years). Nationally, volume offered and never sold (category 1) averaged 2.7% and ranged from 1.2% (2015) to 4.4% (2009). Volume sold after modifications to the original sale (category 2) averaged 5.9% each year, ranging from 3.6% (2013) to 8.5% (2009). Volume sold without modifications, but not at the first offering (category 3), averaged 3.4% and ranged from 1.8% (2007 and 2009) to 6.0% (2019). Nationally, the percentage of timber sold at the first offering (category 4) averaged 88.1% over the period, but was the lowest in 2019 (83.6%), 2020 (84.7%), and 2009 (85.3%) – notably 2009 and 2020 included periods of severe recession in the US.

Figure 4 presents the percent of offerings unsold by year, 2007–2020. This figure can differ from Figure 3 because unsold offerings may be larger or smaller than those sold. Overall, in this period, 89.9% of offerings sold on the first attempt, suggesting the offerings sold on first attempt (category 4) contained slightly less volume, on average, than categories 1–3. Although there is significant yearly variation, there appear to be potential modest decreasing trends in volume of timber (Figure 3) and number of sales offerings (Figure 4) sold at first offering (category 4), with volume sold at first

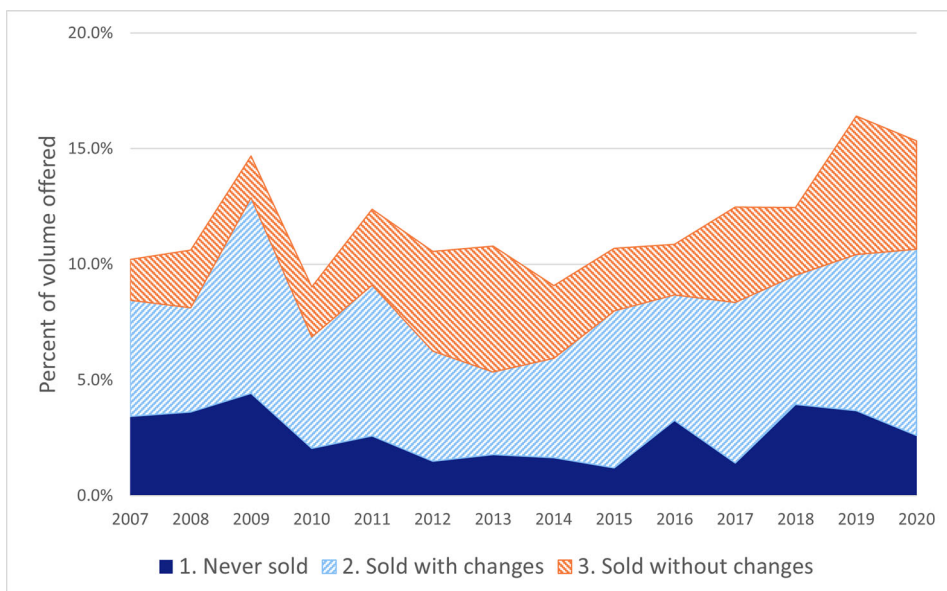


Figure 3. Percent of NFS timber volume offered which could be considered “unsold” or “no-bid”, depending on the stakeholder, by year. The remaining percentage represents timber sold at first offering.

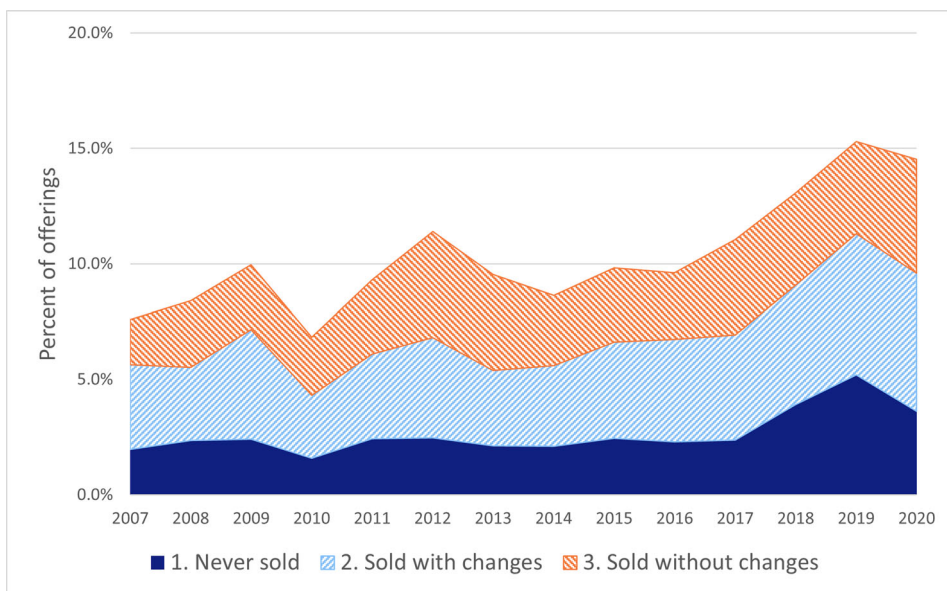


Figure 4. Percent of NFS timber offerings which could be considered “unsold” or “no-bid”, depending on the stakeholder, by year. The remaining percentage represents timber sold at first offering.

offering decreasing from 89.8% to 84.7% and number of sales offerings sold at first offering decreasing from 92.4% to 85.5%. However, most of the volume and offerings still eventually sell with or without modifications (categories 2 and 3), and timber never sold (category 1) does not appear to have increased substantially over the period.

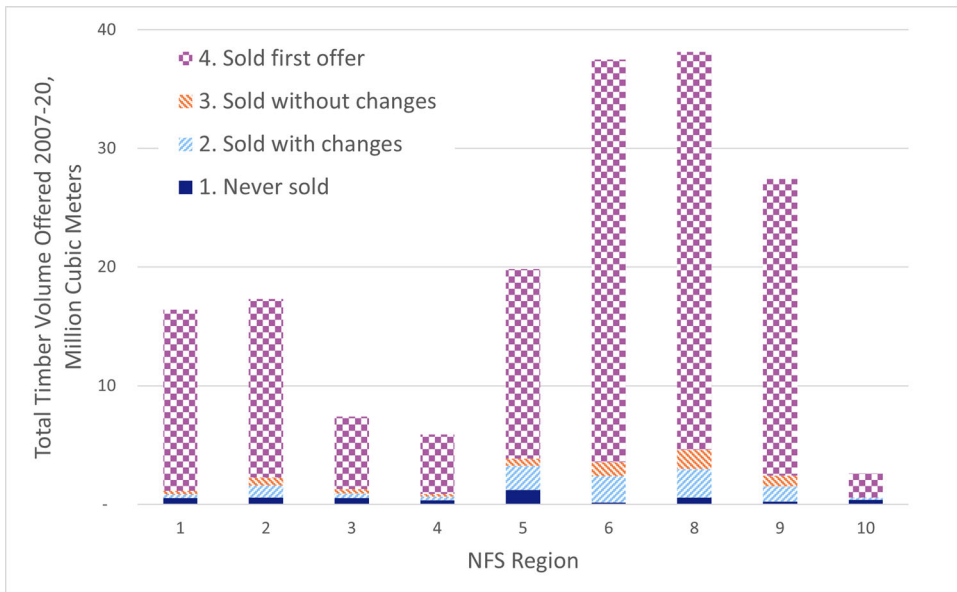


Figure 5. Total NFS timber volume offered during the period 2007–2020 by sale or unsold category, by Region. See Figure 1 for definition of Regions.

Figure 5 presents total timber volume offerings for the entire period 2007–2020, by NFS Region. The Region with the lowest percentage of volume that does not sell at first offer (categories 1–3) is Region 1, with 6.9%. The Regions with the largest overall timber sale programs (Regions 6, 8, and 9) also have high absolute volumes that are not sold on first offer (categories 1–3), although in percentage terms the volume not sold on first offer is still relatively low, at 8.8% for Region 9, 9.5% for Region 6, and 12.1% for Region 8. The Regions with the highest percentage that does not sell at first offer (categories 1–3) are also those with the highest percentage that never sell (category 1): Region 10 with 22.7% and 14.1%, Region 5 with 19.5% and 6.1%, Region 3 with 17.8% and 7.4%, and Region 4 with 14.8% and 5.7%.

4.3. Identification of factors affecting “no-bid” offerings

4.3.1. Synthesis of past research

Relatively little refereed literature has been published specifically on the topic of “no-bids” (unsold timber offerings) from public lands. However, related topics have been studied to a moderate extent. This literature can be grouped into four thematic areas: factors affecting stumpage value of timber from public lands, appraisal methods and accuracy, sales and auction methods, and factors correlated with fewer or no bids. Numerous factors impact the value of stumpage on public land, which include macro-economic conditions, regional supply and demand, natural disasters, regulatory policies, and sale-specific factors (Brown *et al.* 2012b; Klepacka, Siry, and Bettinger 2017). The sale-specific factors that have been linked to higher stumpage values incorporate physical, ecological, policy, and administrative features. Sale-specific and general factors that have been shown to impact the likelihood of selling timber offerings are presented in Table 2.

Table 2. Factors impacting salability of timber offerings from public lands, from literature sources.

Factor	Description of Impact on Salability	References*
Sale-specific		
Timber volume and product class	Timber sales that are too small or have too little volume per unit land area are not economical. Extremely large sales can also be undesirable if the bidders do not have sufficient scale. In general, higher-value products are more desirable.	5, 6, 7, 8, 9, 13, 14, 22
Homogeneity of timber	Fewer product classes allows streamlining log sorting and hauling processes. More classes means hauling logs to different mills.	3, 4, 17
Salvage	Salvage logs may be of low quality or need to be processed quickly to avoid degradation. Landscape-scale salvage operations (e.g. after a large hurricane or wildfire) increase supply in a market region at fixed demand.	6, 8, 12
Silvicultural prescription	Prescriptions may require specific management activities, creating additional work or limiting operating methods.	7, 10, 11
Road construction requirements	Construction of roads may be necessary, but can be a costly component of timber sales.	7, 10, 11, 13
Environmental mitigation	Environmental requirements may add engineering work and reduce the volume of timber available.	10, 11, 13, 19
Location relative to mills or other forestry operations	Proximity lowers hauling and other operational costs.	5, 13, 14
Contractual length of time to harvest	A shorter time period for harvest reduces logger flexibility.	5, 13, 14
Seasonal and other restrictions on harvest	A smaller time window for harvest reduces logger flexibility.	5, 7, 13
Sale timing	Seasonal variability in supply (numerous sales at the same time, e.g. at the end of a fiscal year) or demand (mills securing future inventory) can affect salability.	5, 6, 7, 14
Bid guarantee/downpayment	Large downpayments or guarantees may create cash flow challenges for loggers or seem risky.	13
General		
National and regional macroeconomic health	The macroeconomy generally correlates with demand for lumber, which has a national-scale market. Timber that feeds into mills that supply the lumber, however, is harvested by regional-scale actors and regional mill capacity is fixed in the short run. Therefore, there	20

(Continued)

Table 2. (Continued).

Factor	Description of Impact on Salability	References*
	can be paradoxical impacts of strong national and regional economies.	
Regional timber supply and demand, and competition	Number of loggers and mills competing for timber, and number of large forest landowners in the area competing to sell timber, impact competition. A larger number of potentially interested bidders makes them more likely to offer their highest and best bid.	2, 7, 13, 14, 15, 16, 18, 20, 21
Manufacturing costs in the region	Higher costs to convert timber to lumber lower potential profitability, and thus lower demand.	12
Appraisal calibration and rollback	Specific rules as to how to evaluate timber value impact minimum bids.	1, 2
Regulatory policies	Policies can impact which timber tracts are allowed or desirable to sell. They can also stipulate certain implementation procedures/actions that may alter the cost of harvest.	12, 19

*1 – Adams and Haynes (1989); 2 – Adams and Haynes (1991); 3 – Barr and Perez-Garcia (2006); 4 – Boltz, Carter, and Jacobson (2002); 5 – Brown *et al.* (2012b); 6 – Carter and Newman (1998); 7 – Dahal and Mehmood (2005); 8 – Huang and Buongiorno (1986); 9 – Huebschmann *et al.* (2004); 10 – Kilgore and Blinn (2003); 11 – Kilgore and Blinn (2005); 12 – Klepacka, Siry, and Bettinger (2017); 13 – Kueper, Blinn, and Kilgore (2014); 14 – Leefer and Potter-Witter (2006); 15 – Niccolucci (1989a); 16 – Niquidet and Van Kooten (2006); 17 – Préget and Waelbroeck (2005); 18 – Préget and Waelbroeck (2012); 19 – Schuster and Niccolucci (1989); 20 – Schuster and Niccolucci (1991); 21 – Sendak (1991); 22 – Simmons *et al.* (2020).

An advertised rate that is set too high, either too close to or above the fair market value, can create a situation where the sale is more likely to receive no-bids (Adams and Haynes 1989, 1991; Huang and Buongiorno 1986); if this occurs with frequency, it may be indicative of non-competitive markets (Adams and Haynes 1991). Alternatively, a reserve price that is too low may be more likely to have one or more bids, but may not return a fair market value for the timber. Various appraisal methods have been reviewed (Schuster and Niccolucci 1990), but since TEA is utilized throughout most of the NFS, it has been the most scrutinized. Accuracy of the TEA approach depends on various choices about the exact methods to be used, including the length of the time used for the base period and frequency of averaging for base period price data (Niccolucci and Schuster 1994), whether the BPP only includes local transactions or incorporates broader market fluctuations (Haynes, Skog, and Aubuchon 2016), and the method for adjusting the BPP (Schuster and Niccolucci 1993).

Research on factors affecting stumpage value has also highlighted the complex interplay between appraisal and bidding, and areas where markets and competition may not be perfect (Adams and Haynes 1991). It is perhaps self-evident that incorrect timber appraisals can lead to fewer (or no) bids. However, fewer bids on one sale can also lead to incorrect timber appraisals in the future, as numerous studies have also shown that different numbers of bidders on otherwise similar sales have different sale prices (Dahal and Mehmood 2005; Kueper, Blinn, and Kilgore 2014; Leefer and

Potter-Witter 2006; Niquidet and Van Kooten 2006; Préget and Waelbroeck 2012; Sendak 1991), and sale prices on recent sales are used to create base period prices. The first bidder is the most important in terms of overall revenue, as having at least one bidder is more important than adjusting features to drive up the price of the winning bid (Sendak 1991). Furthermore, the impact of a non-competitive market region (with only one or a few buyers) appears to be moderated somewhat by spatial arbitrage, with the decrease in bid approximating the hauling cost to a more competitive region (Niquidet and Van Kooten 2006).

Timber offerings receiving no bids can influence future appraisals. In a relatively competitive marketplace, exclusion of the no-bids (because the bids are not observed) from the database of base period prices in a TEA appraisal method can upwardly bias appraisals (Gebert, Niccolucci, and Schuster 1998), creating a situation where no-bids generate more no-bids. On the other hand, if competition is limited, the few buyers can potentially game the TEA system by choosing not to bid, with the expectation that the seller will re-appraise the sale and re-offer at a lower price (Haynes, Skog, and Aubuchon 2016).

The method of conducting the sale and bid processes themselves also affects sale price (Brown *et al.* 2012b; Klepacka, Siry, and Bettinger 2017). Furthermore, policy approaches including quotas, set-asides, and priority systems can impact efficiency and equity (Bentley 1968). Lowering the reserve price can attract more bidders and increase total volume sold, but in some cases lowers the winning sale price and overall revenue received (Brown *et al.* 2013; Buongiorno and Young 1984). Impacts of other methods and provisions have been explored, such as keeping the reserve price secret from potential bidders (Marty and Préget 2010), open versus sealed bidding (Athey, Levin, and Seira 2011), small-business set-asides (Haynes 1979), and provisions allowing adjustment of stumpage rate after the fact due to changing market prices (Schuster and Niccolucci 1995).

A few studies have explicitly modeled the probability that a particular timber offering will be unsold. At a broad scale, Schuster and Niccolucci (1991) found that regional timber supply, regional economic conditions, national economic conditions – account for 65% of variation in the annual total volume unsold. However, this does not identify specific sales that will be unsold. Although regression models with traditional revenue and cost-type variables for individual sales can relatively accurately predict winning bid prices for most sales (Buongiorno and Young 1984; Sendak 1991), attempts to predict no-bids in advance with similar models has yielded relatively poor results, correctly identifying no-bids only between 10 and 60% of the time (Gebert, Niccolucci, and Schuster 1998). The best predictive models of timber salability that have been demonstrated to date include both sale-specific factors and broad macroeconomic conditions (Niccolucci 1989a, 1989b).

4.3.2. Interviews

Interviews with NFS personnel and subsequent coding of their responses led to the identification of proximate causes of “no-bid” timber offerings, as well as underlying factors that might influence these causes. Interviews with industry stakeholders conducted after preliminary development also fit into that framework. Tables 3 and 4 list those factors from both groups, along with frequency of mention of each concept. Interviewees cited four categories of proximate causes (or sale-specific drivers) of “no-bids”:

1. High costs (49%): Make timber more expensive to extract.
2. Low revenue (26%): Affect the quality or marketability of the timber.
3. Timing and uncertainty (17%): Include multiple sales at one time or limited periods for the harvest.
4. Unanticipated (4%): Include wildfires and sudden road closures.

Each of these proximate causes may be influenced by four categories of underlying factors:

1. Institutional (57%): Are specific to the FS. Include overall staffing, communication, and involvement of personnel within each stage of the timber sale process. Also how sales are put together, termed “sale design”, and timber targets creating a sense of urgency to get a sale advertised.
2. Market and appraisal (23%): Reflect the ways appraisal tools, current market conditions, and access to market information can affect the proximate causes.
3. Policy (12%): Include rules mandating mitigation measures and contractual issues that can drive the sale design toward infeasibility, along with litigation related to adherence of policy.
4. Operational (8%): Include current road conditions or location of a sale.

4.4. Understanding how factors affecting “no-bid” offerings are perceived and interrelated

4.4.1. Differences in industry and agency perceptions

Although there were clearly consistencies in the issues surrounding no-bids, differences in perception between the NFS and industry employees are important to highlight. Table 3 highlights the frequency that each proximate cause category was mentioned by each group. Industry and NFS personnel both noted high costs as their most frequently mentioned proximate cause category and institutional factors in the underlying factors category (Tables 3 and 4). Notably, high costs related to road packages accounted for a higher proportion of mentions by NFS personnel than by industry personnel.

Industry personnel, in turn, noted equipment or implementation requirements as their most frequent high-cost category. Implementation requirements are mostly associated with silvicultural prescriptions and equipment requirements are the material items needed to harvest. One industry interviewee stated, “We don’t have the equipment we need for the bigger scale. I’d do a lot more if I could get the equipment and get it off the mountain.”

Both NFS and industry personnel noted the same top constraint in the low revenue category: species composition and condition. One industry interviewee noted, “If a sale is a multi-product sale where you have saw log removal and mandatory biomass removal... that can often be problematic for us. Not having a reliable, close proximity outlet for the biomass will often result in an economically unviable project.”

Limited operating periods or seasonal restrictions, categorized under timing and uncertainty, were the most frequently mentioned proximate cause for industry personnel, but less for NFS personnel. For example, one industry professional noted, “We usually – we only got five months to get a year’s supply of timber because of weather and recreation-based activities.” NFS employees do, however, seem cognizant of this

Table 3. Industry ($n=9$) and agency ($n=17$) frequency of mentions of proximate causes of “no-bid” timber offerings in the National Forest System. Bold numbers indicate which group of individuals mentioned that category of causes more frequently.

Category	Industry	NFS
Proximate causes		
High-Cost Total	47%	50%
• High Cost (general)	6%	5%
• Mitigations (Environmental or Restoration)	7%	10%
• Equipment or implementation requirements	12%	8%
• Infrastructure	7%	13%
• Base rate, opening, or minimum bid	7%	0%
• Road Packages	7%	15%
Low Revenue Total	17%	32%
• Low Revenue (general)	2%	2%
• Market Demand	5%	10%
• Species composition and condition	7%	12%
• Volume Per Acre/Size of Sale	3%	7%
Timing and Uncertainty Total	25%	13%
• Timing and uncertainty (general)	1%	0%
• Limited operating periods or seasonal restrictions	18%	6%
• Market saturation	2%	2%
• Risk of marketability	2%	5%
• Sale timing	1%	1%
Unanticipated Total	6%	3%
Uncategorized Proximate Causes Total	5%	1%
Total	100%	100%

Table 4. Industry ($n=9$) and agency ($n=17$) frequency of mentions of underlying factors for “no-bid” timber offerings in the National Forest System. Bold numbers indicate which group of individuals mentioned that category of causes more frequently.

Category	Industry	NFS
Underlying Factors		
Institutional Total	40%	63%
• Institutional (general)	7%	3%
• Communication	9%	20%
• Sale Design and Urgency	14%	17%
• Staffing	9%	23%
Market/Appraisal Total	32%	19%
• Access to mill/market price information	5%	2%
• Appraisal System	19%	9%
• Market Conditions	7%	8%
Policy Total	19%	9%
• Litigation	2%	4%
• Policy Climate	17%	6%
Operational Total	8%	7%
• Operational (general)	2%	0%
• Road Conditions	1%	3%
• Sale Location	4%	4%
Uncategorized Underlying Factors Total	2%	1%
Total	100%	100%

issue, "...in a lot of cases ... we put a lot of restrictions on how many months out of the year they can work. So, timing restrictions can be part of [no bids]."

Underlying factors provide similar diversity of issues across groups, as shown in Table 4. The proximate causes of no-bids can often be straightforward and easily listed. Underlying factors, however, are more difficult to parse out, as they are often intermingled and interrelated with those proximate causes. Indeed, their influence on those proximate causes makes it highly probable that they relate to a direct reason for not bidding on a sale. However, it is still possible to identify trends on underlying factors between the two groups. For example, both groups deemed institutional (FS-specific) factors as the most important. However, industry personnel noted sale design and urgency most frequently. Most of these references were related to infeasibly laid out sale packages. For example, one industry interviewee noted, "It's just little things. The perfect example of this is: we'll have a sale that is 95% ground-based tractor logging and 5% skyline. And they'll put one little 3 acres of skyline out on a road system all by itself, you know? It's just the lack of understanding of the logistics of getting that machine all the way out there to do three acres, you know?" NFS personnel referenced this category (mostly in relation to the urgency of meeting timber targets), but were more concerned with staffing. This includes references to turnover rates or experience levels of agency personnel. One NFS employee noted the difficulty of fulfilling work for timber sales while also having to contend with staff shortages and turnover.

Market and appraisal references were similar in frequency between both groups. Critiques of the appraisal system, specifically, were the most frequent in each group. One NFS employee noted, "When they appraise out a sale ... and they are in tune with whatever is going on in their district and they understand their purchasers ... that gets back to: Are we investing in our purchasers? Are we communicating with them? Are we looking at them as a partner here?"

Furthermore, many individuals referenced geographically specific issues, but the uniform response among both groups was that the appraisal system lags too far behind the market and the agency does not have the flexibility to adjust quickly. Although the industry personnel mentioned policy factors more frequently than NFS personnel, they both noted policy climate as their most frequent issue in that category. Industry personnel tended to mention difficulties with contracts or implementation as their main issue with policy climate, but NFS personnel were more critical of the timeliness or inconsistencies of environmental planning or assessments. Both groups mentioned the operational factor of sale location with a similar frequency. For example, an agency employee noted regarding general sale location, "You're kind of trying to make a silk purse out of a sow's ear because this stuff got passed over once before in terms of the long-term contract, and now we're trying to make something viable out of something that just isn't so great."

These perspectives give both the agency and researchers a comprehensive view of natural trends in no-bids. This can provide a starting point for individual Regions and Forests to understand the complexity of their own issues. Perhaps more importantly, this can equip the leadership within the agency with a more complete picture – but gathering geographic trends is also of great importance.

4.4.2. *Synthesis comments*

Each set of interviewees were asked for a synthesis of the issues, including potential solutions. While industry professionals focused almost exclusively on the appraisal of

the sale, NFS personnel had a few thoughts regarding some of these more immediate factors. One FS employee noted, “All complications are solvable, but we need to have the time and focus to be able to come up with those solutions. If, during initial feasibility, they’re not acknowledging potential complications, they’re not necessarily going to plan for solutions.” Other employees felt that there were not always solutions to the problems, and you simply had to try a sale over again.

At the end of the interview, one industry employee explained his synthesis of the issue: “Folks are really looking for operational certainty. Unexpected events cost more money to the logger. Time is money. The Forest Service does not do a good job providing that certainty. Things come up that aren’t always addressed, and the timeliness of actions is not always in line with industry, you know? Industry is out there on a Sunday; the Forest Service is out there on a Monday. Even a single day delay can be expensive.” Another interviewee emphasized the need for Forest Service decisions on no-bids to reach all employee levels so they can understand how their work impacts the agency as a whole.

4.5. Development of conceptual framework

Based on the historical data, literature synthesis, and interviews, we created a framework describing the causes of “no-bids” (Figure 6), using the conceptual underpinning of proximate and underlying factors (Geist and Lambin 2002). This framework will form the basis of later phases of this research project going forward, but may be modified and improved upon iteratively as more information is collected in those phases.

For each category of underlying factors, we identified four levels of control, based on known hierarchical structures within the NFS, as well as NFS personnel interviewee comments on controllable versus uncontrollable issues. These are not fixed, but overlap and shift, based on areas or issues:

1. Individual and team level: This implies that certain changes in communication, planning, and structure could lead to more success with timber sales.
2. Management (Forest/Region) level: This implies that changes are needed on a management level, such as staffing, more training, lower-level policy changes, etc., which could lead to timber sales that are more likely to receive bids.
3. Policy and leadership level: This implies that larger, structural changes in policy, such as within NEPA, appraisals, or timber targets at the national level, may be needed.
4. Uncontrollable: This denotes that there may be little to no control over this challenge.

5. Discussion and conclusions

This research used synthesis of past research, analysis of historical data, and semi-structured interviews to explore definitions and perceptions, and create a conceptual framework for understanding unsold timber offerings (“no-bids”) from the NFS. Proximate causes are generally sale-specific and relate to direct profitability and feasibility questions (revenue, cost, risk, and timing); these factors closely aligned with past research on public timber sale valuation (e.g. Brown *et al.* 2012b; Buongiorno and Young 1984; Leefers and Potter-Witter 2006). Underlying factors included various contextual considerations that create the conditions for the proximate causes, and

Drivers of No-Bid Timber Sales in the National Forest System

Proximate causes: What immediate factors drive a timber sale to receive no bids?

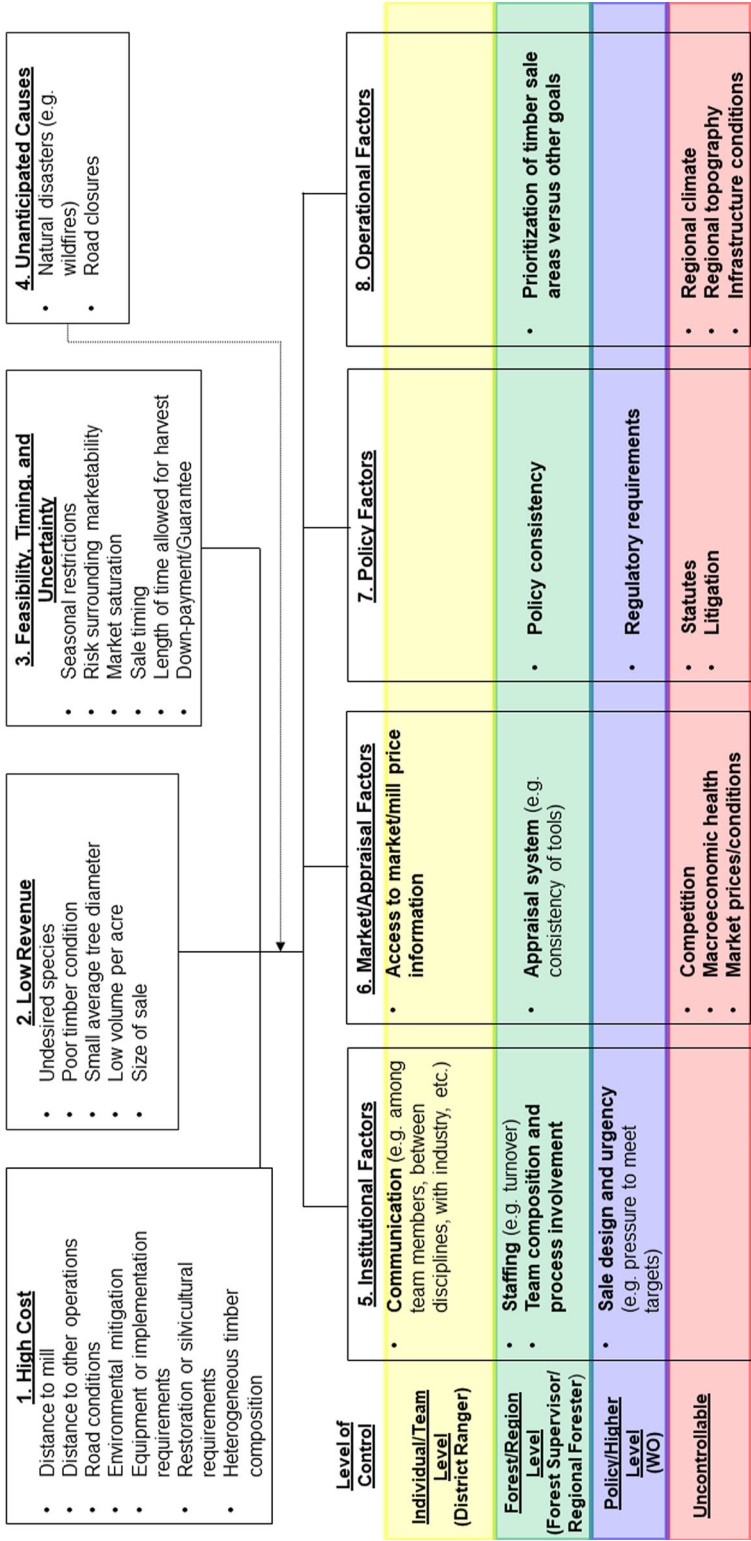


Figure 6. Proximate causes and underlying factors of “no-bid” timber offerings in the National Forest System, identified through interviews.

included institutional, market/appraisal, policy, and operational factors. While past work has also looked at the impact of market and macroeconomic factors on appraisals and no-bids (e.g. Klepacka, Siry, and Bettinger 2017; Niccolucci 1989a, 1989b; Schuster and Niccolucci 1991), we believe this work is the first to explore the institutional, policy, and operational factors that create the context for no-bids. In addition, our work provides clear definitions for the colloquial term “no-bid,” creating a vocabulary to discuss, quantify, and examine sales on NFS lands.

There has been an overall upward trend over time in percentage of volume not sold at first offer (about 10% in 2007/2008 to about 16% in 2019/2020) and percentage of sales not sold at first offer (about 8% in 2007/2008 to about 15% in 2019/2020), with significant yearly variation. However, the percentage of volume never sold has not shown an upward trend. Therefore, depending on one’s perspective, the issue of “no-bids” could be either getting worse or staying the same over time.

Among the proximate causes, issues relating to high costs were most frequently cited among both NFS and industry personnel, notably including equipment or implementation requirements, infrastructure, and road packages. NFS personnel cited low revenues next most frequently, such as species composition and condition, whereas industry personnel were more likely to cite timing and uncertainty issues, including limited operating periods or seasonal restrictions. These issues are broadly consistent with past literature on factors that make timber sales more desirable or profitable (Barr and Perez-Garcia 2006; Brown *et al.* 2012b; Dahal and Mehmood 2005; Huang and Buongiorno 1986; Huebschmann *et al.* 2004; Kilgore and Blinn 2003; Klepacka, Siry, and Bettinger 2017; Kueper, Blinn, and Kilgore 2014; Leefer and Potter-Witter 2006; Préget and Waelbroeck 2005; Schuster and Niccolucci 1989).

Among underlying factors, NFS personnel most frequently cited institutional factors such as communication, sale design and urgency, and staffing. Industry personnel cited these, but also frequently cited market/appraisal and policy factors such as the appraisal system and policy climate. Interviews and past literature agreed that the appraisal system is a foundational aspect of the salability of timber offerings, and that laws and policies play an important role (Adams and Haynes 1989, 1991; Klepacka, Siry, and Bettinger 2017; Schuster and Niccolucci 1989). In other areas, literature and the views of employees seemed to diverge. Past literature has identified market factors impacting timber sales, including overall macroeconomic health, and competition among timber sellers and buyers (Adams and Haynes 1991; Dahal and Mehmood 2005; Kueper, Blinn, and Kilgore 2014; Leefer and Potter-Witter 2006; Niquidet and Van Kooten 2006; Préget and Waelbroeck 2012; Sendak 1991), which were not directly referenced by the interviewees. On the other hand, interviews did highlight institutional factors such as staffing, communication, team composition, and sale urgency, which has not previously been identified in the literature, to our knowledge. All these factors are complex and overlapping; however, there are particular ones that are more easily accomplished or more controllable than others, as indicated in Figure 6. Factors such as communication, staffing, access to mill or price information, and the location of a sale can be controlled more easily than long-standing policy or market conditions.

Future research will utilize this framework of proximate causes and underlying factors to better quantify the magnitude of impacts from the various issues and identify potential changes that may help to reduce the number of “no-bid” offerings. In addition to the variation in responses between agency and industry personnel, the perception of relative importance of factors varies from person to person, depending on their

region and other variables. Although this information has been synthesized to understand this trend on a national scale, pinpointing what was most important to each situation can provide some clarity to potential solutions. Surveys of NFS and industry personnel throughout Regions will give a broader look at perceptions and incorporate the views of a broader group of professionals, including many of those doing work “on the ground,” and allow for comparisons by Region and position type. Econometric modeling will also be conducted to highlight and quantify issues that have greatest impact in specific regions, by comparing the differences between offerings that sell and those that receive no bids.

Given the complex nature of the issue, interactions between the causes and factors, constraints on certain potential actions, and variability between regions, there is likely no “silver bullet” that will eliminate the problem. As noted, many of these selected quotes and mentions from both agency and industry personnel were multi-faceted and overlapped with other issues, which points toward the likelihood of a multi-pronged approach to reduce no-bid timber sales, varying significantly by region. Working with regional directors and timber appraisers to understand their specific needs may facilitate prioritization of actions to reduce no-bids. In highlighting their words, researchers and other stakeholders in timber sales can draw on their expertise to solve this issue. Given the level of knowledge of this issue expressed by our interviewees and others with whom we have discussed this research, it may be that the greatest resource the NFS has is the knowledge and experience of its own personnel.

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Notes

1. Multiple Use Sustained Yield Act, 16 U.S.C. § 528 (1960).
2. National Forest Management Act, 16 U.S.C. § 472a (1976).
3. USDA sets national targets for timber to be sold each year, and these targets are divided among the Regions and Forests.
4. Forest Service Organic Administration Act, 16 U.S.C. § 475 (1897).

5. Forest and Rangeland Renewable Resources Planning Act, 16 U.S.C. § 1600 et seq. (1974).
6. National Environmental Policy Act, 42 U.S.C. § 4321 et seq. (1970).
7. Endangered Species Act, 16 U.S.C. § 1531 et seq. (1973)
8. Notably, litigation associated with protection of the Northern spotted owl under the Endangered Species Act, 16 U.S.C. § 1531 et seq. (1973)
9. It is not clear which definition of “unsold” was used, as discussed below.
10. Timber sale administrators record information in TIM including volume of the timber sale, list price, sale price, year at which each Gate is completed, among others.

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