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Does collaboration affect the duration of environmental permitting processes?

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Abstract

While collaborative governance has many benefits for environmental planning and management, those benefits are not politically feasible if they impact process efficiency. This study assesses collaboration's effect on the duration of water permitting processes, specifically the United States' Federal Energy Regulatory Commission's hydropower relicensing process. Collaboration was measured using a survey of participants in 24 recent hydropower relicensing processes. A Cox proportional hazards model with mixed effects assessed the relationship between collaboration, regulatory framework, hydropower facility characteristics and relicensing process duration. Collaboration was not associated with time to license. Instead, process duration depended on the regulatory framework (especially the switch to the Integrated Licensing Process and presence of endangered species) and facility characteristics (generating capacity and facility type). The results suggest that agencies should consider engaging collaboratively during planning and permitting, given that collaboration's benefits to decision quality do not incur a cost on overall process time.

Keywords: collaborative governance; water resources planning and management; process efficiency; FERC hydropower relicensing

1. Introduction

Since the late 20th century, the environmental sector has undergone a substantial increase in the use of collaborative planning and management. In collaborative processes, public entities work with a diverse array of interested participants ("stakeholders" in collaboration parlance) to jointly develop solutions to problems that cannot be solved unilaterally (Ansell and Gash 2008; Gray 1989; Selin and Chavez 1995; Emerson and Nabatchi 2015b). Collaborative processes have proliferated at a rate faster than academics can evaluate them, so studying collaboration's performance is of utmost importance (Emerson and Nabatchi 2015a; Koontz and Thomas 2006).

There is growing understanding of collaboration's proximal and long-term effectiveness. Collaboration can create agreement and buy-in to a decision because people from multiple sides of a contentious issue were involved in solving it (Emerson et al. 2009; Scott 2011). Collaboration can enlarge the scope of information being used in a decision-making process (Armitage et al. 2015; Beierle and Cayford 2002; Connick and Innes 2003; Dale and Armitage 2011; Korfmacher and Koontz 2003), potentially improving the technical basis upon which decisions are made, and help stakeholders learn about the problem (Brummel et al. 2010; Koontz 2014; Cravens 2016) to craft more innovative solutions. Collaboration can result in rigorous, implementable policies that balance between competing resource uses (Ulibarri 2015a); these decisions are both satisfying to process participants and more likely to improve economic, social, and environmental outcomes (d'Estree and Colby 2004; Leach and Sabatier 2005; Ulibarri 2015b). Finally, collaborative decision-making has been shown to enhance environmental protection (Scott 2015; Heilmayr and Lambin 2016; Scott 2016).

However, research that systematically considers collaboration and efficiency—defined as the resource, time, and staff costs needed for a given outcome (Ostroff and Schmitt 1993)—is scarce. In research drawing on participant opinion, government employees report improved efficiency, including reduced costs and delays, when they work collaboratively (Mitchell, O'Leary, and Gerard 2015; Emerson and Nabatchi 2015a). And using actual cost data, Andrews and Entwistle (2010) find that inter-organizational partnerships delivered equally effective services with decreased expenditures.

In the environmental realm, time to decision is a key component of efficiency, as delaying the implementation of new programs or permits postpones potential benefits to the environment and/or economy (Kosnik 2006) and longer duration processes increase staff time and administrative costs for all parties (Sunding and Zilberman 2002; Decker 2003). However, collaboration's potential effect on duration is ambiguous and understudied. In particularly contentious settings, bringing stakeholders into dialogue from the start of a process—increasing collaboration—is encouraged as a way to alleviate conflict-induced delays (Weber and Khademian 2008). On the other hand, it is generally acknowledged that effective collaboration requires face-to-face time (Ansell and Gash 2008; Leach and Pelkey 2001; Margerum and Whitall 2004; Susskind, McKearnen, and Thomas-Lamar 1999), as it entails bringing diverse participants together, helping them trust one another, and working toward a shared understanding and decision. The substantial face-to-face time collaboration requires is a concern for understaffed and under-resourced organizations (Yaffee and Wondolleck 2010) and has led some negotiated rule-making processes to lessen formal collaboration requirements (Cook 2015).

To address the dueling possibility that collaboration can either reduce delay or increase process time, this paper asks whether increasing collaborative engagement affects the overall duration of water permitting processes. It uses data from recently completed hydropower licensing processes in the United States to test the relationship between level of collaboration, regulatory framework, facility characteristics, and time for a hydropower facility to receive a license. Findings indicate that process duration is associated with regulatory framework and facility characteristics but not level of collaboration, suggesting that increasing collaboration can benefit environmental planning and management without incurring time efficiency costs.

2. Case background: FERC hydropower relicensing

Hydroelectric generation is a core component many energy systems. As a renewable, low greenhouse gas emitting energy source that can be turned on quickly to meet variable demand, hydropower is an important component of a clean-energy system (Kosnik 2008; National Hydropower Association 2015). However, hydropower facilities also negatively affect the environment and, in some cases, society. Diverting water through turbines shifts the timing and magnitude of flows that would naturally occur in the river, altering sediment movement and erosion, temperature and chemical regimes, and aquatic habitat (Ligon, Dietrich, and Trush 1995; Poff et al. 1997, 2007). Storage facilities block fish migration (Larinier 2000) and shift a portion of the river from riverine to lacustrine, affecting habitat and recreational opportunities (Stephenson 2000). Hydropower facilities may also displace communities, flood farmland, and inundate cultural sites (Goldsmith and Hilyard 1986; Tilt, Braun, and He 2009).

The Federal Energy Regulatory Commission (FERC) regulates the approximately 2500 non-federally owned hydropower facilities in the US. Two principal tenets influence FERC's regulatory approach. First, when FERC's authorizing legislation (the Federal Power Act) was drafted in 1920, the federal government was concerned that hydropower allowed private entities to take advantage of rivers that were in the public domain. To prevent exploitation, FERC issues 30- to 50-year licenses, allowing periodic reevaluation of the hydropower facilities' economic and social value (Kosnik 2014). Second, in 1986, recognizing the need to balance the positive and negative impacts of hydropower development, a 1986 Federal Power Act amendment required that FERC give "equal consideration" (16 U.S.C. §797 (e)) to power generation and non-power values like wildlife and recreational opportunities when making a licensing decision (DeShazo and Freeman 2005; Moore, Maclin, and Kershner 2001).

To achieve the required "equal consideration," FERC has utilized a series of administrative approaches for licensing hydropower projects, each promoting a different approach to cross-party collaboration. The traditional approach operates like many public consultation processes. The applicant conducts whatever studies it deems necessary to assess the impacts of the project and then submits an application to FERC. FERC then conducts an environmental impact assessment. Federal and state resource agencies[1], tribes, non-governmental organizations (NGOs), and other parties are invited to comment at four stages: on the applicant's proposed study plan, on the draft license application, and on the draft and final environmental assessment. FERC also seeks approval that the license meets regulatory requirements under the Federal Power Act, Endangered Species Act, Clean Water Act, and other statutes through consultation with relevant agencies.

This process was regularly plagued by delays. Only "about one third of traditional license process proceedings [were] concluded before the existing license expire[d]" (Federal Energy Regulatory Commission Office of Energy Projects 2004, A-14), with some relicensings lasting over 20 years (Kosnik 2006). Recognizing these challenges, some utilities began voluntarily engaging stakeholders before the license application was submitted. The idea was that through

[1] I use the term "resource agencies" to encompass non-FERC government agencies involved in the process. These generally include land management agencies (e.g., US Forest Service), fish and wildlife agencies (e.g., California Department of Fish and Wildlife, National Marine Fisheries Service), and water quality agencies (e.g., Oregon Department of Environmental Quality). Under the Federal Power Act, some agencies have "mandatory conditioning authority" over a project, meaning that they can mandate specific measures in the license; others submit comments that FERC reviews like any other public comment.

early issue identification and principled negotiation stakeholders could develop mutually beneficial operating regimes to propose in the license application and reduce conflict post-application.

This approach was formalized in 1997 with the creation of the Alternative Licensing Process (ALP), which aims to "facilitate greater participation" by relevant stakeholders and to "promote cooperative efforts by the potential applicant and interested entities and encourage them to share information about resource impacts and mitigation and enhancement proposals and to narrow any areas of disagreement and reach agreement or settlement of the issues raised by the hydropower proposal" (18 C.F.R. §4.34 (i)). The ALP is a self-designed process, tailored to an individual project's circumstances (Kosnik 2010). Approximately five years before the existing license expires the utility initiates the relicensing by filing a notice of intent, and then the participant group (utility, resource agencies, tribes, and NGOs) jointly decides on an appropriate timeline, develops and carries out a study plan, and develops the license application. To streamline consultation post-application, the environmental assessment is due at the same time as the application. Like the other processes, resource agencies file their conditions after the application is submitted.

Licensing participants felt that the ALP swung the pendulum too far toward open collaboration. Because the process was tailored to each individual project, there were no concrete timeliness in the ALP and licenses were still taking upward of ten years to issue. Moreover, the traditional process was still preferred by utilities (Kosnik 2010).

Recognizing that both extremes of the traditional process's post-hoc consultation and the ALP's self-designed collaboration had problems, FERC initiated a collaborative rulemaking to develop a new licensing process (Purdy 2012). In 2003, FERC introduced its Integrated Licensing Process or ILP, which aimed to resolve relicensing's long timelines, making the process more certain for everyone involved, yet still allowed for early issue identification and collaboration between parties (Kosnik 2010). Since July 2005, the ILP has been the default licensing process.

The primary change in the ILP is a strict timeline to (ideally) allow licensing processes to be completed before the old license expires. Approximately five years before license expiration, the utility files its notice, along with a process plan and schedule, existing information about the project and its known impacts, and a proposed study list. In subsequent stakeholder meetings, relicensing participants agree on a study plan. If there is a dispute over the studies, informal and formal dispute resolution are available, triggering review by a three-member technical expert panel. The utility then conducts one to three years of studies, with several required stakeholder meetings to share in-progress and final study reports. Then, the utility uses the study results to develop their license proposal, and agencies and NGOs use study results to develop their proposed licensing conditions. In more collaborative ILPs, the application and proposed conditions may be identical if they are developed jointly.

Relicensing participants undergo the same phases in the ALP and ILP: issue scoping, resource studies, and developing management recommendations. The difference is that FERC sets more deadlines and required submissions in the ILP. In both processes, FERC generally issues a license that incorporates the utility's application (whether or not it was developed collaboratively) plus requirements submitted by resource agencies with mandatory conditioning authority, so utilities have an incentive to negotiate with resource agencies so their requirements are in the utilities' favor. Beyond that, FERC does not require stakeholder agreement or consensus on submitted materials, nor does it specify how much utilities must collaborate (except the required public outreach meetings).[2] In both the ALP and ILP, some utilities choose to work jointly with a

[2] FERC does encourage consensus because it generally accepts consensus-based settlements without modification;

diverse set of organizations and seek consensus through each phase of application development, some utilities do not negotiate with anyone, and some collaborate somewhat. Thus, when using a theoretically-derived measure of collaboration, both ALPs and ILPs were found to sometimes be high collaboration and sometimes be low collaboration (Ulibarri 2015a, 2015b). Collaboration's effect can therefore be assessed separately from differences in regulatory design. For the remainder of the paper, "level of collaboration" refers to measured differences in deliberation, negotiation, and trust across cases—*de facto* collaboration—rather than the *de jure* requirement to bring people together (where they may or may not work jointly).

FERC relicensing is a promising case to assess collaboration and process duration. Because permitting delays have been a core concern in reforming the FERC processes, identifying factors influencing time to license has direct policy relevance. Moreover, individual relicensings vary substantially in level of collaboration (Ulibarri 2015b) and in time to license (Kosnik 2006), the two variables of interest, yet are fairly similar in other factors that might influence process duration (e.g., types of resources managed and stakeholders involved).

3. Hypotheses

The primary question addressed by this study is whether, given a mandate to collaborate, differences in collaborative engagement affect the duration of permitting processes. As noted in the introduction, there is a tension between literature that suggests that collaboration should shorten versus lengthen process duration. Arguments that collaboration shortens duration note that bringing stakeholders together at the start of a process can help overcome pre-existing conflict and distrust such that an agreement can even be reached at all (Weber and Khademian

thus, the utility and other stakeholders can be more certain of what FERC will decide if they reach an agreement. Without an agreement, FERC weighs the various submissions and issues a license it deems to best balance between power and non-power interests.

2008) and can create buy-in to a decision (Emerson et al. 2009; Scott 2011), reducing the likelihood of lawsuits or other delays by dissatisfied stakeholders. Arguments that collaboration should lengthen duration note that building trust between stakeholders (Ansell and Gash 2008), developing “shared understanding of the issues” (Margerum and Whitall 2004, 424), and increasing problem-solving capacity (Susskind, McKearnen, and Thomas-Lamar 1999) take time (Leach and Pelkey 2001).

In the context of FERC relicensing, I expect both of these features to exist during different phases of the relicensing. In the application development phase, when the bulk of face-to-face stakeholder input occurs, engaging more collaboratively should increase duration because it takes time to jointly negotiate study plans and license applications (and develop the trust necessary to do so). In a relicensing operating with the minimally required level of collaboration, the utility, resource agencies, and NGOs work unilaterally to develop the application and proposed conditions, with a few public hearings—an approach that should take relatively less time because they are not seeking agreement. After the application is submitted, however, higher collaboration processes should be faster as participants have already reached agreement on license requirements and other stakeholders should feel that their interests have been met, limiting the need for public comments or lawsuits.

> *H1: Higher collaboration processes will be associated with longer pre-application times and shorter post-application times.*

While collaboration is the primary object of study, the environmental permitting literature suggests additional factors that could affect relicensing duration. First, differing regulatory requirements are expected to affect process duration if they add consultations and complexity (Rabe 1995; Hammah 2015; Ulibarri, Cain, and Ajami 2017). In FERC relicensing, facilities that might affect federally-protected endangered species require consultation with the US Fish and Wildlife Service or the National Marine Fisheries Service. For hydropower projects, aquatic endangered species are more likely to require a lengthy formal consultation (as opposed to an informal concurrence letter), as their habitat is directly dependent on the flow, temperature, and water quality affected by the facility. Thus, it is expected that relicensings for facilities with aquatic endangered species in the project area will take longer than those without.

Another regulatory trigger occurs for projects located on federal land, as the relevant land management agency (e.g., US Forest Service) can condition requirements for projects on their property. While land management agencies submit these conditions concurrent to other comment periods, the added regulatory complexity is expected to extend process duration during the post-application phase.

However, not all regulatory differences slow down expected timelines. Deadlines have been shown to speed up permitting processes (Carpenter, Zucker, and Avorn 2008; Yackee and Yackee 2010), so the switch between the ALP with few deadlines and the ILP with strict deadlines should shorten the duration of relicensings.

> *H2a: Relicensings for facilities with aquatic endangered species in the project area will be associated with longer times, particularly post-application.*
>
> *H2b: Relicensings for facilities located on federal property will be associated with longer times, particularly post-application.*
>
> *H2c: Relicensings using the ILP will be associated with shorter times than those using the ALP across both the pre- and post-application phases.*

The political climate surrounding a relicensing should also affect duration. Being located in a more environmentally progressive state has been shown to quicken regulatory approval for environmentally favorable decisions (Ando 1999), including traditional FERC relicensings (Kosnik 2006), as political leadership can put pressure on regulatory agencies to reach favorable decisions. This trend is expected to hold in more recent relicensing processes.

> *H3: Projects located in states with pro-environmental political leadership will be associated with shorter durations than those in less environmentally supportive states.*

Finally, facility size and complexity are expected to affect relicensing duration. In traditional licensing processes, larger facilities—using reservoir storage and drainage area as proxies—were found to take longer to relicense (Kosnik 2006; see also Decker 2003). There is no reason to assume that the switch to ALP or ILP should affect this relationship. In this analysis, the facility's electrical generating capacity and whether it is managed for multiple purposes (rather than just hydropower) are used to estimate complexity. It is assumed that, all other parameters held equal, larger capacity facilities or those operated for more than one purpose are more complex and therefore will take longer to relicense. Hydropower facility type also relates to complexity. Run-of-river facilities tend to have fewer environmental impacts than facilities with a storage dam; because they pose less of a tradeoff between power production and environmental goods, they are hypothesized to have shorter relicensing timeframes.

> *H4a: More complex facilities—larger capacity or multipurpose facilities—will be associated with longer durations than smaller or single purpose facilities.*
>
> *H4b: Run-of-river facilities will be associated with shorter durations than either storage or pumped storage facilities.*

4. Methods

The data for this analysis include a survey of relicensing participants to measure collaboration and process and facility data obtained from the FERC online library (http://elibrary.ferc.gov). The analysis was conducted with every ALP and ILP—every relicensing that had the possibility to be collaborative—that received a license between 2007 and 2012, which includes 24 relicensings in 12 states. This is a small sample size, as using a survey to measure collaboration constrained the possible time frame to recent cases. Relicensing processes take five or more years, so a cutoff date earlier than 2007 would entail asking participants to recall events occurring over a decade prior. Due to this limitation, the study's findings are exploratory, suggesting relationships but not confirming a causal link.

The dependent variable is the duration of the relicensing process. The primary analysis is conducted for *overall time to license*, the time in days between the utility submitting its notice of intent and FERC issuing the new license. To understand whether there are differential effects over the timespan of a relicensing, separate analyses were conducted for the pre-application and post-application phases. *Pre-application* is the time between the notice of intent and the utility submitting the final license application. This phase includes scoping for the environmental analysis, technical studies, and development of preliminary operating protocols as codified in the license applications; it is when the bulk of collaboration occurs. The *post-application* phase is the time from the license application to the new license. This is primarily occupied by FERC's environmental impact analysis well as approval by other conditioning agencies, although in some relicensings technical studies and/or stakeholder negotiation may be ongoing; collaboration likely plays less of a role following the license application compared to the regulatory triggers.

The primary independent variable, *Collaboration*, is an index of collaboration based on the "Integrative Framework for Collaborative Governance" (Emerson, Nabatchi, and Balogh 2012), one of the most comprehensive and widely used conceptual models of collaborative governance. The integrative framework defines collaboration as consisting of three dynamics: principled engagement, shared motivation, and capacity for joint action. Principled engagement describes how participants interact with one another, with a focus on deliberation and interest-based negotiation. Shared motivation describes participants' sense of emotional buy-in to the process, focusing on whether participants trust one another, feel their interests are met, and find the process legitimate. Capacity for joint action reflects the resources, information, and leadership are available to support joint decision-making (Emerson, Nabatchi, and Balogh 2012). I developed survey questions translating the components of these dynamics into the context of FERC relicensing; the 20 survey items on collaboration are presented in Table 1. They were averaged into a single collaboration scale, with Cronbach's $\alpha = 0.958$.[3]

[Table 1 about here]

The survey was conducted online in spring 2013 with participants in the 24 relicensing processes. Names were gathered from official contact lists and meeting attendance records to create a census of participants in each process; they were all invited to complete the survey. Of 1162 eligible invitees, 275 responded to the survey (representing a 24% response rate); 231 answered all collaboration items and are used in this analysis. These individuals represent hydropower utilities (17.8%), federal agencies (23.7%), state agencies (25.9%), local governments (8.5%), tribes (5.6%), NGOs (14.4%), and interested public (4.1%). Response rates are similar across all 24 relicensings and across each organization type, so the data are not likely to be underreporting any group that might bias my findings.[4]

The role of the regulatory environment is captured by a series of dummy variables

[3] In general, a Cronbach's α above 0.8 is considered to represent sufficient reliability for use in statistical tests.
[4] The survey was approved by Stanford University's Institutional Review Board [Protocol #26261]. For more information on the survey development or administration, see Ulibarri (2015b).

representing presence or absence of regulatory triggers. They assess whether the relicensing used an ILP (*Process* = 1) or ALP (*Process* = 0); whether there were any endangered aquatic species located within the project boundary (*AquaticES* = 1);[5] and whether the facility was located on federal land (*FedLand* = 1).

Political climate is measured by the average League of Conservation Voters score—which ranks how frequently an elected official voted in a pro-environmental manner—for the two senators from the state where the facility is located in the year the license application was submitted (*LCVScore*). This is a continuous variable with range of 0 (neither senator voted for any of the environmental bills introduced to the Senate) to 100 (both senators voted for all environmental bills introduced to the Senate).

Finally, a series of variables capture facility characteristics related to complexity. The generating capacity (*lnCapacity*) is the log-transformed nameplate generating capacity of the facility in megawatts, and represents the size of the facility. *Multipurpose* assesses whether the facility is operated solely for hydropower (value = 0) or whether it is also operated for flood control, water supply, or another water management purpose (value = 1). Facility type assesses whether the facility is run of river (*RunRiver*), storage (*Storage*), or pumped storage (reference category).

Descriptive statistics for all variables are provided in Table 2.

[Table 2 about here]

Time to license was assessed using a Cox proportional hazards model (Cox 1972), a common approach for modeling regulatory process duration (Ando 1999; Decker 2003; Kosnik

[5] Species listed as "threatened" under the ESA are not included. The analysis was tested for both all endangered species and just aquatic endangered species; however, very few cases had no endangered species present and the effect was larger for aquatic species.

2006). While it is possible to simply regress process duration on the independent variables, time can only assume positive values and therefore does not approximate a normal distribution. A proportional hazards model uses time data to estimate a baseline hazard function $\lambda_0(t)$ —in this case, the probability that a hydropower facility receives a license *t* days after its NOI. Covariates affect the baseline hazard multiplicatively; the coefficients estimated by the model indicate whether each independent variable shifts the hazard function up (reducing overall time to license) or down (increasing overall time to license). The models presented here include fixed effects for collaboration (estimated for individual *i* in relicensing *r*), the vector of *k* regulatory and political characteristics, and a vector of *m* facility characteristics.

This analysis adds a mixed-effects component to the hazards model, as the data exist at two nested levels. Estimates of collaboration are collected for individual *i* within relicensing *r*, while regulatory and facility characteristics are collected for relicensing *r*. The standard approach of including a relicensing-level fixed effect would yield a potentially biased estimate, given the small number of respondents per case. Instead, a random effect u_r is used to nest data at the relicensing level, alongside fixed effects for the independent variables (West, Welch, and Galecki 2006), an approach that is robust for datasets with low *n* per cluster (Raudenbush 2008). Analysis was conducted using the *coxme* package (Therneau 2015) in R version 3.1.2.

The full model, repeated for each of the three time periods of interest, is:

$$\lambda(t) = \lambda_0(t) \exp\left(\beta_1 Collaboration_{ir} + \sum_k \beta_k Regulatory_{kr} + \sum_m \beta_m Facility_{mr} + u_r\right) \quad (1)$$

5. Results

Figure 1 displays Kaplan-Meier survival curves for the three time periods. The Kaplan-Meier curve is a nonparametric maximum likelihood estimate of the baseline survival function—

the probability that after *t* days a relicensing process leaves that phase (either by submitting the license application or receiving a new license). The dotted lines are 95% confidence intervals.

[Figure 1 about here]

For overall time to license, median survival is 2048 days, indicating that 50% of facilities are relicensed within about 5.5 years and therefore more or less on schedule. The steep initial slope of the Kaplan-Meier curve shows that these “on time” relicensing are fairly closely clustered. The rate of change then declines, suggesting that for facilities not licensed on schedule, it becomes increasingly likely they receive a license in the next timestep the longer they wait. To compare the two sub-periods, the pre-application phase (the middle column) has little variation between the shortest and longest relicensings. In contrast, the slope in the post-application phase is more gradual, indicating a higher variation in duration across relicensings. This suggests that much of the “delay” comes after the Final License Application is submitted and decision-making is in FERC and other conditioning agencies’ hands.

[Table 3 about here]

The mixed-effects hazard model results are shown in Table 3. To interpret each covariate’s relationship with time to license, a positive coefficient signals a shorter time to license and a negative coefficient signals a longer time. The larger the coefficient’s magnitude, the larger the impact. Model fit is indicated by the Bayesian information criterion (BIC), a model selection criterion that depends on the maximized value of the likelihood function, the sample size, and the number of covariates (Wit, Heuvel, and Romeijn 2012). A lower value indicates a better-fitting model; because the BIC depends on the dependent variable, it is not comparable across the three models.

Collaboration was not significantly associated with duration for any time period, so the results do not support the hypotheses that higher collaboration extends application development or reduces post-application review.

The results partially support the regulatory characteristics hypotheses. As hypothesized, relicensings with aquatic endangered species were associated with longer time overall and post-application ($p < 0.001$). However, projects on federal land were not statistically different in overall duration, but were significantly shorter during pre-application ($p = 0.031$). And while relicensings using the ILP were shorter than those using the ALP in overall time and post-application ($p < 0.001$), they were longer during the pre-application phase ($p < 0.001$).

Political climate was also associated with relicensing duration, but not in a consistent fashion. Projects in environmentally-friendly states were likely to have shorter pre-application phases ($p < 0.001$) but longer post-application phases ($p = 0.028$); overall time was not significantly affected.

The results partially support the hypothesis that more complex facilities are associated with longer relicensings, as larger capacity facilities were slower during all three phases ($p < 0.001$). However, while the negative coefficient on multipurpose suggests that single-purpose facilities had shorter durations, the effect is only statistically significant during pre-application ($p = 0.001$). Finally, run-of-river facilities were the slowest to move through all three phases ($p < 0.001$)—the opposite of the hypothesized relationship.

6. Discussion

The primary aim of this research was to assess whether increasing collaboration affected the overall duration of relicensing processes, to understand whether efficiency costs are associated with collaboration's environmental benefits. According to the analysis, having a higher or lower level of collaboration was not associated with longer or shorter relicensing times.

During application development, it was hypothesized that the many face-to-face meetings and efforts to engage across organizational boundaries observed in high collaboration processes would take more time; however, developing applications collaboratively did not translate into longer overall times. At the same time, increasing collaboration was not associated with a shortened post-application duration. In FERC relicensing and elsewhere, engaging stakeholders early in the process was proposed as a way to reduce delays caused by commenting agencies and stakeholders (Ando 1999; Davidson 1982; Dwyer, Brooks, and Marco 1999; Kosnik 2006). The analysis presented here does not support this rationale, as relicensings with more collaboration pre-application did not have shorter review times post-application.

That collaboration is thought to both shorten and lengthen decision-making processes could explain the null result: maybe collaboration has different time effects for different types of processes. For some cases, collaboration is needed to resolve protracted conflicts (Weber and Khademian 2008), leading to a shorter overall duration than a traditional comment-based regulatory process. For more simple cases, collaboration may add time because absent lengthy deliberations, the processes would have been a quick back-and-forth with paper comments.[6] Assuming both antecedent conditions exist among the relicensings studied, the net impact of collaboration on overall process duration would be neutral.

The null result, however, is an important finding. While collaboration may not make processes *more* efficient, this study suggests that collaboration does not increase overall time. That means the many benefits associated with collaborative processes may be achieved without any added time (and the associated staff and resource costs)—a substantial finding in support of collaboration's use in environmental planning.

[6] Importantly, this approach could overlook some stakeholders' interests.

This analysis also suggests non-collaboration factors that may make environmental permitting more efficient. The regulatory framework—which relicensing process was used and which consultations and conditioning authorities were triggered—was associated with varied time to license. As hypothesized, the presence of aquatic endangered species was associated with longer times in post-application review. This makes sense, as a separate consultation is required for projects with endangered species present, and aquatic endangered species are most likely to require a formal consultation if present. However, not all consultations added time. Overall, projects located on federal land were indistinguishable from those not on federal land, and were associated with slightly faster pre-application times. This suggests that any voluntary consultation between the utility and land management agency occurs concurrently to other approval processes.

Additionally, the switch from the ALP to the ILP was associated with shorter overall relicensing times. Because the ILP coefficient estimates the expected change in duration *holding level of collaboration equal*, the observed effect can be attributed to the primary regulatory difference, namely the ILP's strict deadlines. This supports prior research that deadlines can speed up regulatory processes (Carpenter, Zucker, and Avorn 2008; Yackee and Yackee 2010). However, the use of ILP versus ALP only had an association overall and post-application; pre-application, ALPs were slightly faster. This suggests that the ILP's timelines incentivized better coordination between the various authorizing agencies (FERC, state water agencies, land management agencies, and fish and wildlife agencies) while they reviewed the application, but did not lead to faster application development.[7]

[7] While the small sample size in this analysis did not permit use of interactions, assessing an ILP*Endangered Species interaction would provide insight into whether the ILP indeed speeds up agency review. Specifically, are projects with aquatic endangered species faster under the ILP than ALP?

The political climate was inconsistently associated with relicensing duration. While having pro-environmental congressional representation has been found to hasten regulatory approval (Ando 1999; Kosnik 2006), in this case a pro-environmental climate was associated with faster application development but extended agency review. A potential explanation is that regulatory agencies act more stringently in more environmentally friendly states (Potoski and Woods 2002), which would suggest that post-application consultations and approvals in these states may take longer. Paired with political pressure to approve the new license quickly, the net effect of political pressure would be neutral, as was observed for overall time.

Larger capacity facilities were associated with longer relicensing times, as did facilities operated for multiple purposes beside hydropower during application development. Kosnik's (2006) analysis of traditional relicensings attributed a similar finding to complexity—that it would take longer for FERC to assess the impacts of large, complicated facilities than small ones. This makes intuitive sense. More complicated facilities have to collect more data on a more varied set of parameters. With more parameters come more varied stakeholder interests, which may complicate bringing the group to a joint decision (Margerum 2011). Multipurpose facilities have by definition more resource interests built into their operations, likewise expanding potential stakeholders. Facilities with more substantial potential impacts likely require multiple study seasons versus a single season. These features would all extend the pre-application phase. Post-application, FERC and the other conditioning agencies would have more data to assess in determining how to license more complicated projects.

However, the facility type measure undermines this complexity hypothesis. If magnitude of impact mattered, run of river facilities should take the least time because they are the least environmentally impactful. This was not the case; run of river projects were associated with slowest times through all three phases. Pumped storage facilities being the fastest to relicense might partly be due to a bias in the sample, as there were only two pumped storage facilities assessed, making it harder to generalize. However, that run-of-river facilities—the smallest and least impactful facilities—were slowest suggests that complexity may not be the driving factor.

The fact that facility type's impact varied by time period suggests an explanation. Run of river facilities were substantially slower in the pre-application phase (when the process is in the utility's hands) than post-application phase (when the process is in regulatory agencies' hands), indicating that differences in the utilities' capacity to follow complex application requirements and prepare an application quickly may drive the delay. Most run of river facilities in the sample are owned by rural electric cooperatives or paper companies; these utilities likely have less prior experience with FERC relicensing and fewer resources to dedicate to the process than a large municipal or private electrical utility.

7. Conclusion

Collaborative governance provides many procedural and substantive benefits to both environmental managers and the communities that rely on the resources managed (Scott 2015; Ulibarri 2015a; Connick and Innes 2003; Mandarano 2008). Understanding whether these benefits are associated with efficiency costs helps to assess the full value of collaboration. This analysis demonstrated that FERC hydropower relicensing process duration—an important component of efficiency—was not associated with level of collaboration, but rather with regulatory and facility characteristics.

As one of the first studies to assess the relationship between collaboration and process efficiency, these findings are preliminary. Several limitations provide fruitful avenues to expand the research. First, instrument validity is always a concern and biases in the collaboration scale may have contributed to the null finding. Relying solely on participant perspectives may yield biased estimates of collaboration if participants revise their memory of the process based on their opinion of its outcomes (Leach and Sabatier 2005). The survey instrument was built around one of the most thorough and widely used conceptual models of collaboration (Emerson, Nabatchi, and Balogh 2012) and the survey data do correspond to document-based collaboration measures that were gathered for the same cases (Ulibarri 2015c). These suggest that the collaboration measure used here is unlikely to be biased. However, triangulating these results with additional measures of collaboration could make the analysis more robust.

Second, the study has a small sample size, limiting the number of covariates that could be tested. As discussed earlier, the data suggest that there may be interesting interactions between different regulatory triggers. For instance, ILPs that have an endangered species present could shorten the post-application phase (if the ILP's influence on duration is stronger) or lengthen it (if the Endangered Species Act's is stronger). Testing this interaction would probe the extent of the ILP's ability to incentivize effective coordination across consultation processes, leading to useful insights for streamlining other permitting processes that require multiple approvals (Hammah 2015; Ulibarri, Cain, and Ajami 2017).

Third, this analysis considered only one measure of efficiency: overall time to license. Time has many different scales; while collaboration may not increase overall time, it may affect the number of hours spent making the decision given the number of in-person meetings (Margerum and Whitall 2004). This impact is often cited as a concern of deliberative collaboration, but has not been quantified. Other measures of efficiency that could be assessed for collaboration include process cost and cost-benefit ratio. Another factor to consider is the distribution of impacts—who incurs the costs and who gains the benefits—given the democratic aims behind collaborative decision-making (Fiorino 1990; Leach 2006). For instance, a traditional process may have required agencies one month of consultation, whereas with collaboration they could be involved for years. For the utility, this same process could be faster because it is not drawn out through delayed approvals. Understanding these differential effects is important for assessing collaboration's full impact.

A final avenue for future analysis is to assess the relationship between collaboration and time in other collaborative governance processes. FERC relicensing, like many environmental permitting processes, is highly regulated with clear deliverables and a concrete path from the collaborative group's output to an implementable policy. In contrast, for watershed collaborations and other ad hoc management groups, timelines (if they exist) are developed by the group, and there may not be clear start and end dates. However, given the proliferation of grassroots groups, understanding collaboration's impact on their efficiency is an important question for improving environmental management around the world.

Despite these limitations, this research adds to the growing body of literature supporting the use of collaborative engagement. The primary policy implication is thus that environmental managers should seriously consider engaging in deliberative decision-making with non-governmental actors. For guidance on how to ensure strong collaboration, readers can consult multiple clear and well-written guides (e.g, Bryson, Crosby, and Stone 2006; Fisher, Ury, and Patton 2011; Susskind, McKearnen, and Thomas-Lamar 1999; Bryson et al. 2013; Emerson and Nabatchi 2015b). Additionally, this research highlights the value of timelines for overcoming regulatory delay. At the same time, it suggests that regulatory reform alone cannot speed up slow permitting processes, as the political context and facility characteristics also shape how complex a permitting process will be.

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Table 1. Collaboration survey items

Dynamic 1: Principled Engagement
All parties with a significant interest in the issues and outcome were involved throughout the process.
Participants agreed about the goals of the relicensing.
Participants sought solutions that met common needs.
Participants worked together to identify information needs.
Participants worked together cooperatively.
Dynamic 2: Shared Motivation
I felt that what I brought to the relicensing was appreciated and respected by other participants.
I achieved my goals better working with other participants than working alone.
The relicensing process hindered my organization from meeting its own mission.[a]
The relicensing process operated on the principle of mutual respect.
Other participants took my opinion seriously in the course of discussions.
Participants were committed to the process.
Other participants were honest and sincere.
Other participants were trustworthy.
Dynamic 3: Capacity for Joint Action
All participants had access to relevant information.
The relicensing process operated according to mutually agreed upon ground rules.
The process was managed in a neutral manner.
The process provided equal opportunity for participation of all parties.
The process was managed effectively.
I understood the information used in the relicensing.
All participants accepted the validity of information used in the relicensing.

Note: Response options use a 7-point Likert scale, 1=Strongly Disagree, 7=Strongly Agree.
[a]This item was reverse coded.

Table 2. Descriptive statistics

Variable	N	Mean	Std Dev
Overall time to license (days)	24	2141	555
Pre-application (days)	24	1177	108
Post-application (days)	24	964	509
Collaboration	231	5.26	1.11
Aquatic Endangered Species present	14	0.58	
On Federal Land	15	0.63	
Used ILP	13	0.54	
Senate LCV Score	24	65	39
Log Generating Capacity (MW)	24	1.62	1.00
Facility Type	24		
Run of River	6	0.25	
Storage	16	0.67	
Pumped Storage	2	0.08	
Multipurpose use facility	8	0.33	

Table 3. Time to license model results

	Model 1 Overall Time to License		Model 2 Pre-Application		Model 3 Post-Application	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Collaboration	0.01	0.07	0.02	0.07	0.01	0.07
AquaticES	-9.36 ***	1.47	0.13	0.49	-11.45 ***	1.77
FedLand	-0.98	1.87	1.39 *	0.64	2.68	2.26
ILP	9.83 ***	1.58	-2.28 ***	0.56	10.73 ***	1.86
LCVScore	-0.03	0.02	0.05 ***	0.01	-0.05 **	0.02
lnCapacity	-2.86 ***	0.57	-1.64 ***	0.21	-3.80 ***	0.70
RunRiver	-23.13 ***	4.16	-9.72 ***	1.43	-33.14 ***	5.12
Storage	-15.79 ***	3.03	-5.23 ***	1.04	-25.28 ***	3.84
Multipurpose	-2.48	1.47	-1.74 **	0.54	-2.42	1.76
BIC	1030.69		575.55		1068.5	

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

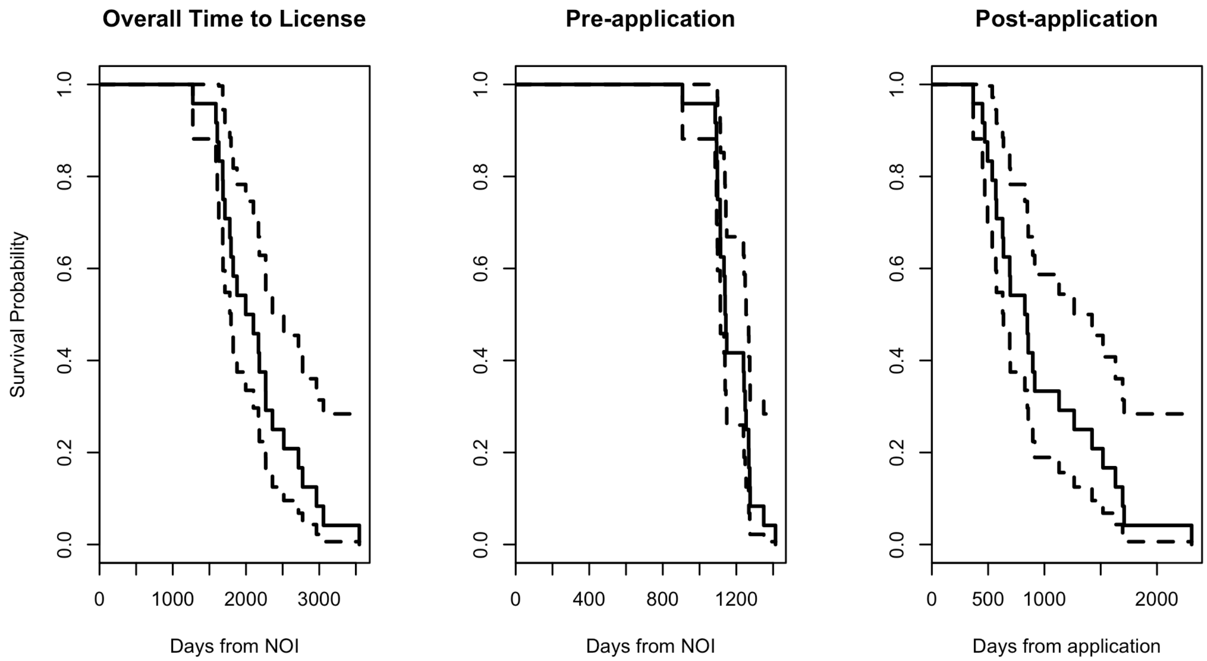

Figure 1. Kaplan-Meier survival curves for the three time periods