Nicholas Institute for Environmental Policy Solutions
Working Paper
NI WP 14-02
April 2014

Empirical Insight into Section 10 Permitting under the Endangered Species Act

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Acknowledgments
The authors appreciate helpful comments provided by G. David Garson and Lydia Olander on previous drafts of this manuscript and research assistance provided by William Norten and Michael Goralczyk. Any remaining errors are the authors' alone.

How to cite this report
Christopher S. Galik and John T. Bowman. 2014. *Empirical Insight into Section 10 Permitting under the Endangered Species Act*. NI WP 14-02. Durham, NC: Duke University.

Contents

EXECUTIVE SUMMARY

Recent discussions about the Endangered Species Act (ESA) have emphasized proactive conservation of at-risk species. Many of these discussions draw from the broad authorizations outlined in Section 10 of the act. Since the late 1990s, research has endeavored to develop a fuller picture of the role of Section 10 programs in ESA implementation, but a broad-based understanding of permittees' experience with the Section 10 permit process is lacking. Taking better stock of how ESA plans and agreements have historically been used is a critical first step in evaluating their potential to be used in new and expanded ways in the future.

Although exploratory, this analysis is nonetheless helpful in increasing understanding of Section 10 program implementation. It investigates differences in the design, application, and approval process for three types of Section 10 plans and agreements: habitat conservation plans (HCPs), safe harbor agreements (SHAs), and candidate conservation agreements with assurances (CCAAs). It finds geographic variation in plan and agreement use and in applicant types and covered land uses. It also finds differences in the number of species covered and in trends in the use of all three plans and agreements. Finally, it finds evidence that larger areas or longer permit durations could be associated with lengthier permit approvals.

A greater emphasis on proactive conservation will likely require that existing tools be targeted differently or that new tools be developed to meet the needs of species, stakeholders, and regulatory agencies. This report finds minimal cross-over between applicant type and land use type among plans and agreements, suggesting that attempts to facilitate future multi-applicant, multi-land use agreements *based on existing* Section 10 approaches should not rely on a single framework. Land uses are different, needs vary by applicant type, and species management requirements are diverse and situation-dependent.

Greater use of Section 10 plans and agreements likewise requires that barriers to their design and implementation be reduced. Previous research suggests that plans covering a relatively large number of acres, activities, or species may hold outsized conservation effectiveness, but this report suggests that they could be associated with longer permit approval times. It likewise suggests that presidential administration plays a role in the length of time between initial permit notification and final permit issuance, further implying that some existing administrative processes could facilitate permit approval should use of Section 10 approaches be emphasized in the future.

INTRODUCTION

The Endangered Species Act (ESA) was passed in 1973 "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" and "to provide a program for the conservation of such endangered species and threatened species" (ESA, Sec.2(b)). To achieve these objectives, the ESA employs a variety of requirements, prohibitions, and planning processes. Central to these is the prohibition against the take ("harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" Sec. 3(19)) of a listed species.

Section 10 of the ESA authorizes "take" of a species in two situations. The first includes non-federal activities conducted to enhance the survival of a species (e.g., active restoration of habitat, captive breeding, reintroduction of extirpated species). The second and more common situation is species take incidental to some other activity (e.g., construction). Permits for these takes are generally referred to as *enhancement-of-survival permits* and *incidental-take permits,* respectively. Among the former are safe harbor agreements (SHAs) and candidate conservation agreements with assurances (CCAAs); among the latter are habitat conservation plans (HCPs). Together, these broad Section 10 authorizations and planning processes provide the basis for many conservation activities undertaken by private landowners and state and local public entities.

The role of Section 10 programs in ESA implementation has been the subject of much research. It includes surveys on plan and agreement use (Hood 1998) and discussions of incentives and disincentives presented by Section 10 approaches in relation to other ESA provisions (Wilhere 2009). Some studies have investigated the conditions under which landowners are likely to develop voluntary conservation agreements (Langpap and Wu 2004). Others have explored the conservation effectiveness of plans on the species they address (Langpap and Kerkvliet 2012).

The plans and agreements authorized under Section 10 collectively authorize a broad suite of conservation activities. In light of recent initiatives undertaken by the U.S. Department of Interior to facilitate conservation efforts under the ESA (e.g., 77 *Fed. Reg.* 28347, May 14, 2012), a broad-based understanding of permittees' experience with Section 10 plans and agreements remains a critical information need. To fill this data gap, this analysis investigates differences in the design, application, and approval process for HCPs, SHAs, and CCAAs. Specifically, it explores differences in users and uses of these plans and agreements as well as how permitting time, land size, and other characteristics vary within and across them.

METHODS

Data

On February 25, 2014, ESA Section 10 permit data were acquired from the Fish and Wildlife Service Conservation Plans and Agreements Database (http://ecos.fws.gov/conserv_plans/public.jsp). Downloaded records for 805 plans and agreements included 693 HCPs, 84 SHAs, and 28 CCAAs. The data provide quantitative metrics on land size, number of species covered, and plan duration. They also provide qualitative data on applicant type and land use under the conservation agreement. For each plan or agreement, the following information was extracted:

- Acreage covered by the conservation agreement (data reported in terms of linear miles were excluded),
- Lead FWS region,
- Duration (in years) of the agreement,
- Type of applicant(s),
- Land use(s),
- Total number of species covered, and
- Dates on which a given plan was noted in the *Federal Register* and on which a permit was issued (the difference between which was used as a proxy for permit approval time, measured in days).

Of these records, 205 were removed due to missing data. Also removed were an additional 36 records with a recorded plan size of "0" acres, 31 records with a permit duration of "0" years, 13 records in which the permit was recorded as approved before ever being noted in the *Federal Register* (thus resulting in a negative permitting time), and 3 records in which permit notice and approval were recorded as occurring on the same day (thus resulting in a permitting time of zero). The final dataset thus consisted of 517 records, of which 446 are HCPs, 54 are SHAs, and 17 are CCAAs.

Statistical Analysis

Permit approval time can provide insight into the administrative burden associated with different plan or agreement types, both the burden to the agency to review and approve as well as the burden to the applicant or participant to plan or to carry project-related expenses in the interim. The hypothesis is that more complex plans—those covering a relatively large number of species, activities, or acres—will be subject to longer approval times. A secondary hypothesis is that enhancement-of-survival permits will be subject to shorter approval times than incidental-take permits. In light of the present push for voluntary, proactive conservation efforts, a lower level of administrative burden could free up scarce agency resources while encouraging greater use Section 10 plans and agreements.

The influence of a variety of plan attributes on Section 10 permit approval time is assessed using Cox regression, a semi-parametric survival history model. It has been used to assess the efficacy of medical interventions on disease onset (Iakovou et al. 2005) or relapse (Robinson et al. 1999), the approval times associated with new medications (Carpenter et al. 2009), the failure rates of new businesses (Audretsch and Mahmood 1994), the factors influencing rates of technology diffusion (Lee et al. 2003), and power plant development patterns (Walls et al. 2007). Table 1 lists all the variables used in this study. General findings are summarized below; Appendix A provides a more detailed description of the statistical model and its output.

Table 1. Variables Assessed in the Cox Regression Model.

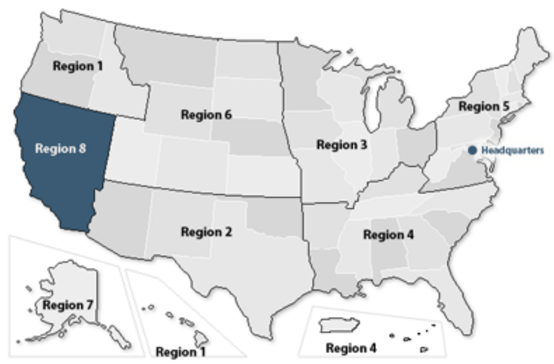
Variable Name	Description
PermittingTimeDays	Permit approval time (days)
Status	Permit approval status (1 if approved; 0, otherwise)
AdminIssued	Administration under which the permit was issued (Ronald Reagan, George H.W. Bush, and Bill Clinton [1]; George W. Bush [2]; Barack Obama [3])
PlanType	Type of permit sought (ITP, ESP)
Region	Lead FWS permitting region
CenteredSpecies	Number of species affected by the permit, centered
CenteredDuration	Duration of the permit (years), centered
LogLandSize	Area covered by the permit (log acres)
NumberLandUseTypes	Number of land use types covered by the permit

Prior to analysis, continuous data were centered, with the exception of plan size, for which the analysis used the log of plan acreage. The analysis focuses on the discrete interval between public announcement and final approval. It is possible, and indeed likely, that preliminary discussions or other actions attributable to the permitting process occurred prior to listing of the plan or agreement in the *Federal Register*. For example, Johnson and Weiss (2006) recommend contacting wildlife agency staff before submission of applications to minimize formal permit review time. To assess the influence of policy priorities, a new variable to reflect the presidential administration in which the permit was issued is also created for this analysis. To assess the influence of inter-regional policy, approach, expertise, or experience, the region in which the plan or agreement is recorded. For plans or agreements that span more than one region, the lead region on record is chosen. Due to the small number of records in the early years of Section 10 program implementation, *AdminIssued* was condensed into three categories: (1) Reagan, H.W. Bush, and Clinton; (2) W. Bush; and (3) Obama. Despite the low number of records from some regions, *Region* was not collapsed into a fewer number of categories as there is no intuitive reason to do so. Given the large number of HCPs relative to both SHAs and CCAAs, plan type was collapsed into incidental take permit (ITP; HCPs only) and enhancement of survival permit (ESP; SHAs and CCAAs) categories.

RESULTS

A comparison of disaggregated Section 10 plans and agreements across regions (Figure 1) reveals interesting geographic trends (Figure 2). For example, patterns differ by plan or agreement; Region 4 (Southeast) comprises a majority of HCPs, but Region 1 (West Coast and Hawaii) comprise a majority of CCAAs and SHAs. An examination of the plans and agreements reveals that the average number of species included in each varies substantially (Figure 3). The average number of species in SHAs and CCAAs do not differ significantly ($p=0.53$), but the average number contained in HCPs varies significantly: SHAs ($p<0.001$) and CCAAs ($p<0.05$). A further breakdown of the distribution of species count across aggregated ITPs and ESPs shows that single-species plans dominate (Figure 4). Both categories have multiple instances of 10 or more species, but the rarity of plans containing double-digit species makes it difficult to identify consistent themes at this end of the species count distribution.

Figure 1. FWS Regions.



Source: http://www.fws.gov/endangered/regions/index.html.

Figure 2. Number of Approved Plans and Agreements by Region for HCPs, SHAs, and CCAAs.

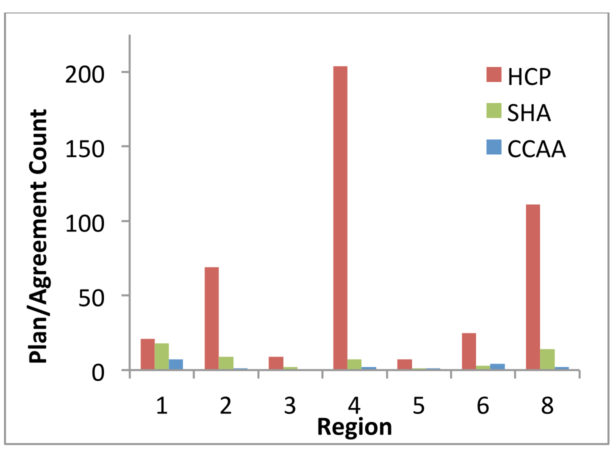


Figure 3. Average Number of Covered Species per Plan or Agreement.

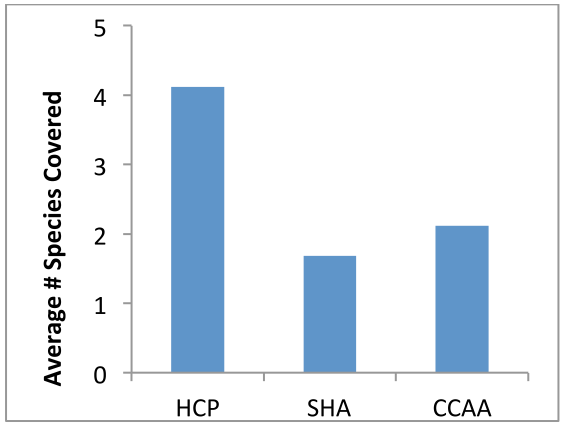
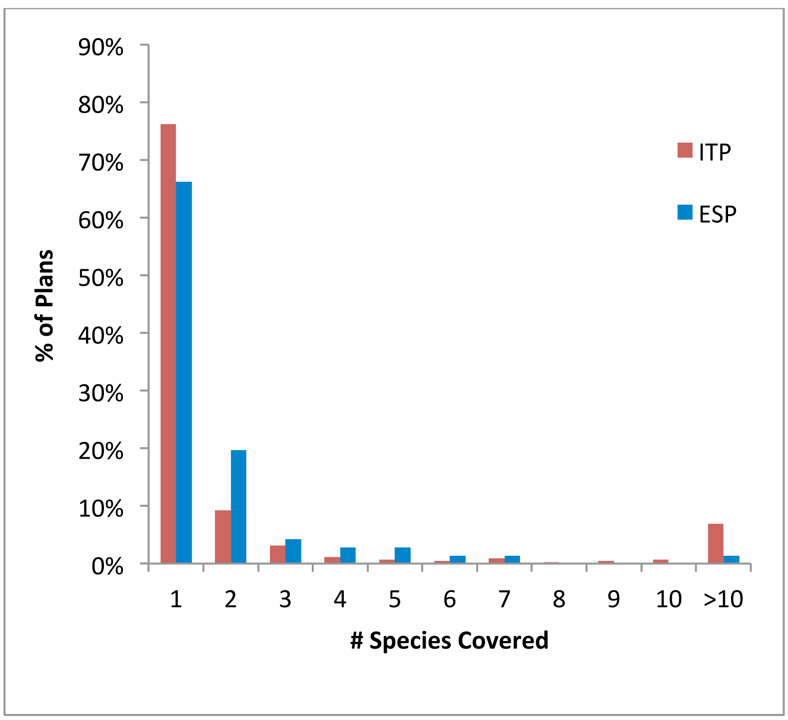
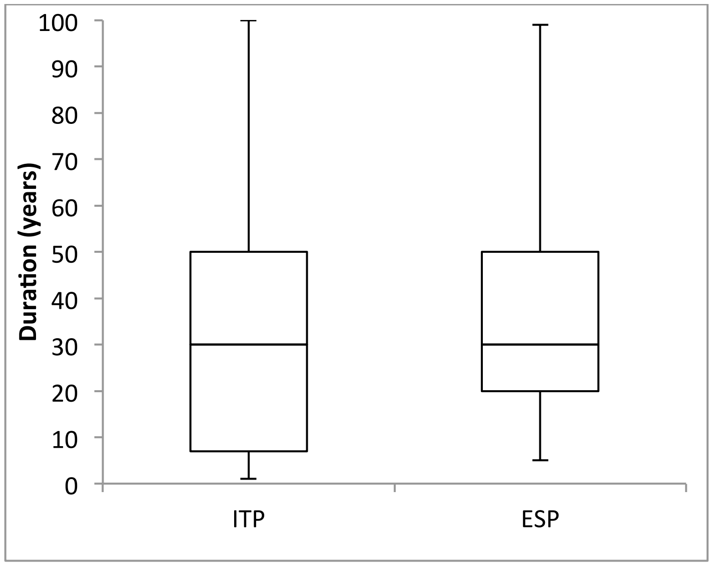


Figure 4. Relative Number of Approved Plans or Agreements with a Given Number of Species.



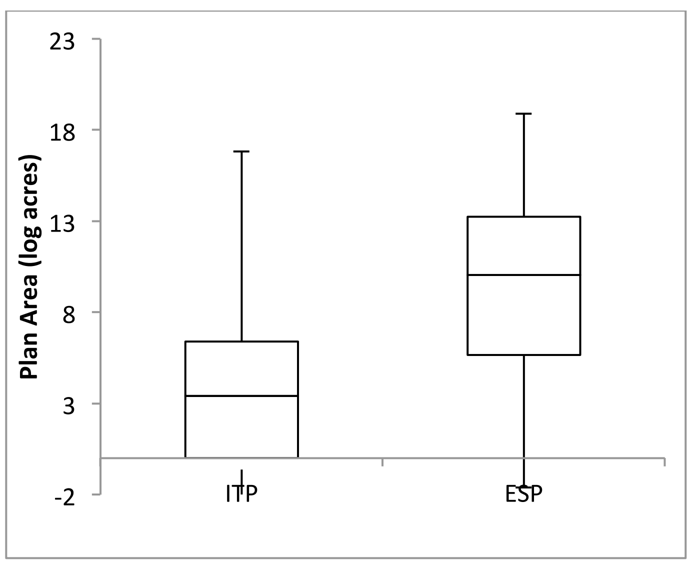
Analysis of plan and agreement duration, or the length of time an approved plan or agreement will be valid, reveals substantial variation both within and across plans and agreements. The duration for ESPs is more narrowly distributed than that for ITPS (Figure 5). Analysis of plan size shows that ITPs feature a large number of plans at the smaller end of the scale, whereas a majority of ESPs are at the larger end of the distribution (Figure 6).

Figure 5. Box Plot of Plan Duration by Plan or Agreement Type.



Note: Error bars display minimum and maximum for each. The box bounds the 1st and 3rd quartiles of the data and is bisected by the median.

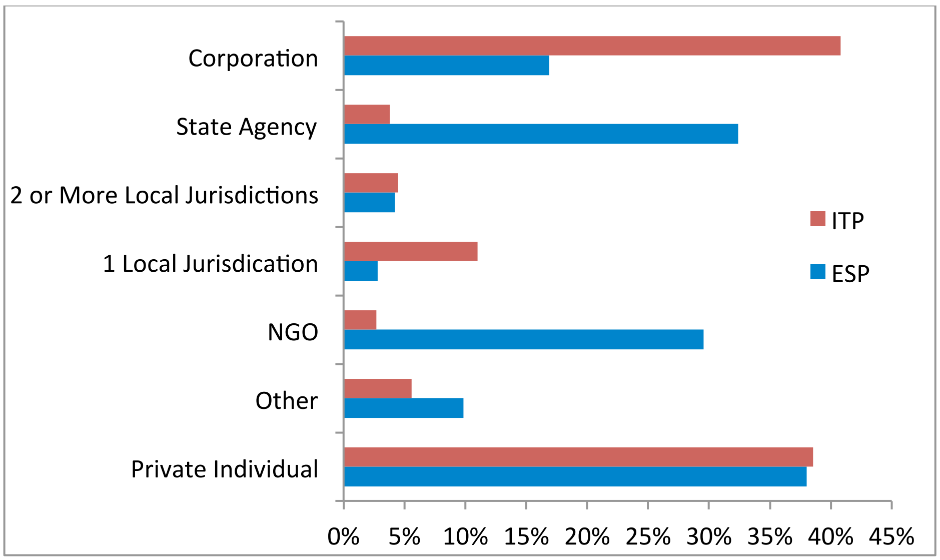
Figure 6. Box Plot of Plan Area (Log Acres) by Plan or Agreement Type.



Note: Error bars display minimum and maximum for each. The box bounds the 1st and 3rd quartiles of the data and is bisected by the median.

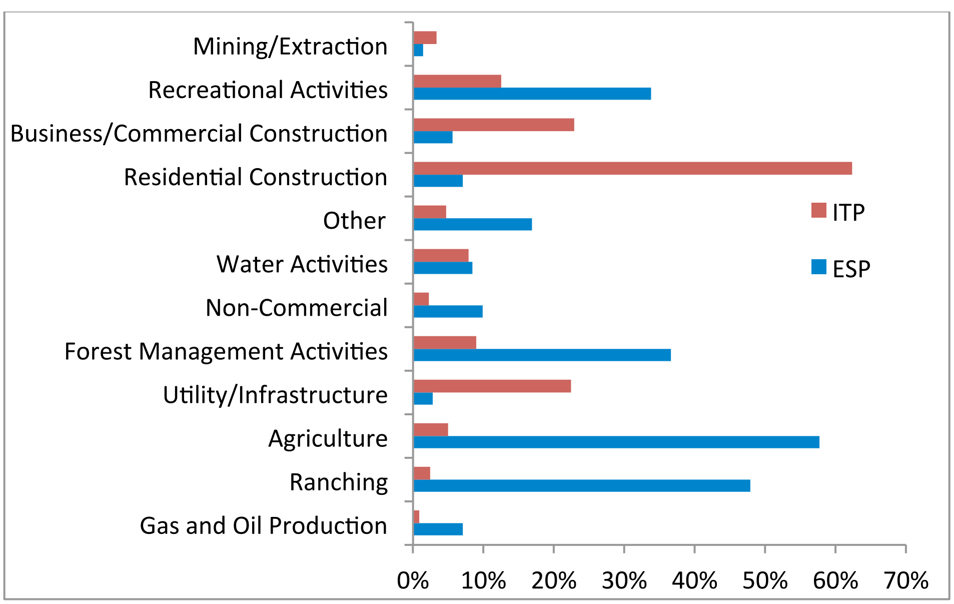
The breakdown of applicant types by conservation type reveals that corporations account for a larger percentage of ITPs than for ESPs. NGOs and state agencies account for a greater percentage of ESP applications (Figure 7). The private individual category is fairly evenly split across plan and agreement types. A breakdown of land uses by conservation agreement type reveals that ranching, agriculture, and forest management account for a larger percentage of ESPs than for ITPs, while plans involving residential, business, and commercial construction account for a significantly larger percentage of ITPS (Figure 8) Gas and oil production applicants make greater use of ESPs than utility and infrastructure applicants, which make greater use of ITPs.

Figure 7. Percentage of Each Plan and Agreement Featuring Each Applicant Type.



Note: Totals may exceed 100%, because each plan or agreement may contain more than one applicant.

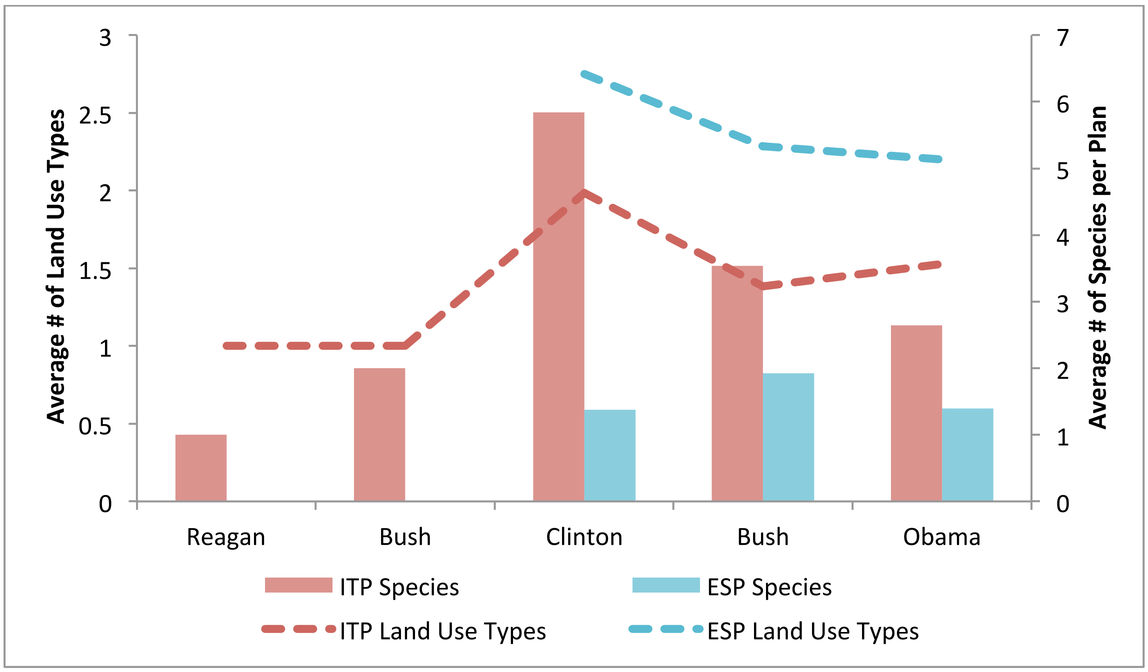
Figure 8. Percentage of Each Plan and Agreement by Land Use Type.



Note: Totals may exceed 100%, because each plan or agreement may feature more than one land use.

Viewing plans and agreements in the context of the administration that they were approved suggests several other interesting trends (Figure 9). For example, the Clinton administration promoted the use of HCPs as long-term conservation tools that could cover both listed and non-listed species. A large part of this push was the "no surprises" policy (63 *Fed. Reg.* 8859; February 23, 1998), a policy designed to strengthen the incentive for landowners to engage in long-term conservation plans by addressing permittees' need for certainty in the context of changing ecological conditions. Average numbers of species and land use types per ITP peaked during this administration, perhaps reflecting its emphasis on HCPs as integrated planning tools. The number of species per ITP has fallen in successive administrations with little or no change in the average number of species and land uses in ESPs.

Figure 9. Average Number of Land Uses and Species in Approved Plans by Presidential Administration.



Average permit time across the dataset averages 200 days, with a standard deviation of 246 days. As Figure 10 shows, permit time varies across FWS regions for both ITPs and ESPs. Over time, both ITPs and ESPs show a slight increase in permit approval time, possibly due to the presence of a few outliers (Figure 11).[1] Assuming no change in the complexity of plans or agreements and no change in agency resources to review them, it is difficult to determine whether observed trends (or lack thereof) are to be expected. A case could be made for increasing permit approval time as each plan or agreement is assessed against the backdrop of an increasing number of previous approvals, listed species, fragmented habitats, and so on. A case could likewise be made for decreasing permit approval time, as both agencies and permittees gain experience in plan development and review.

[1] Further examination of outliers does not suggest systematic bias, however. For example, the dataset examined here included 14 plans or agreements, including 10 HCPs and 2 CCAAs, with a permit approval time of two or more years. Of this total, 12 consisted of a single applicant but only 5 consisted of a single land use type. Seven were quite large (more than 10,000 acres); 4 others were fairly small (20 or fewer acres). Species count ranged from 1 to 81; 10 of the 14 plans or agreements covered 6 or fewer species.

Figure 12 shows more clearly the trend in permit approval time for both plan and agreement types in each of the last three administrations. The number of approved plans and agreements peaked in the George W. Bush administration. This total includes a small number of plans that were applied for but not approved under the Clinton administration but is largely comprised of applications made and approved wholly within the Bush years.

Figure 10. Average Permit Approval Time (in Days) by Region for ITPs and ESPs.

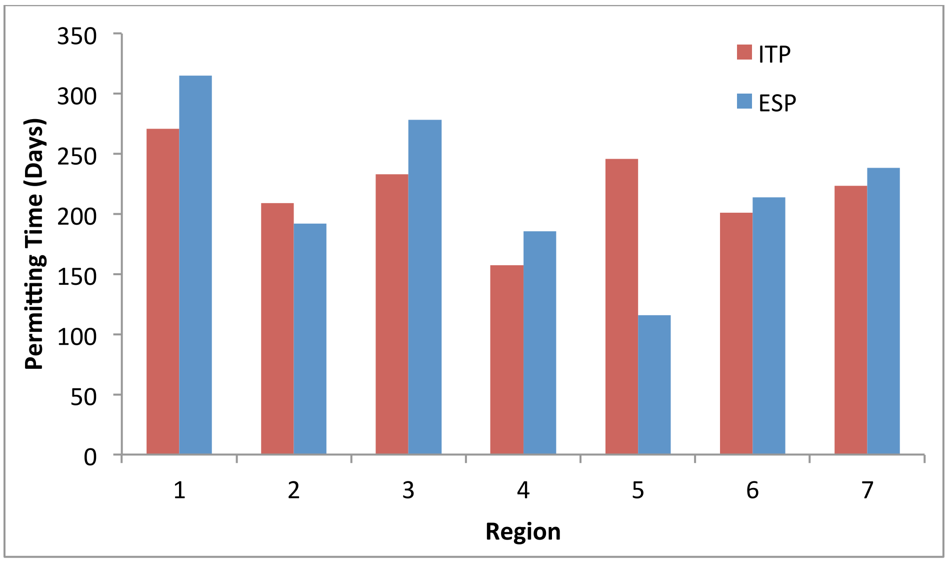
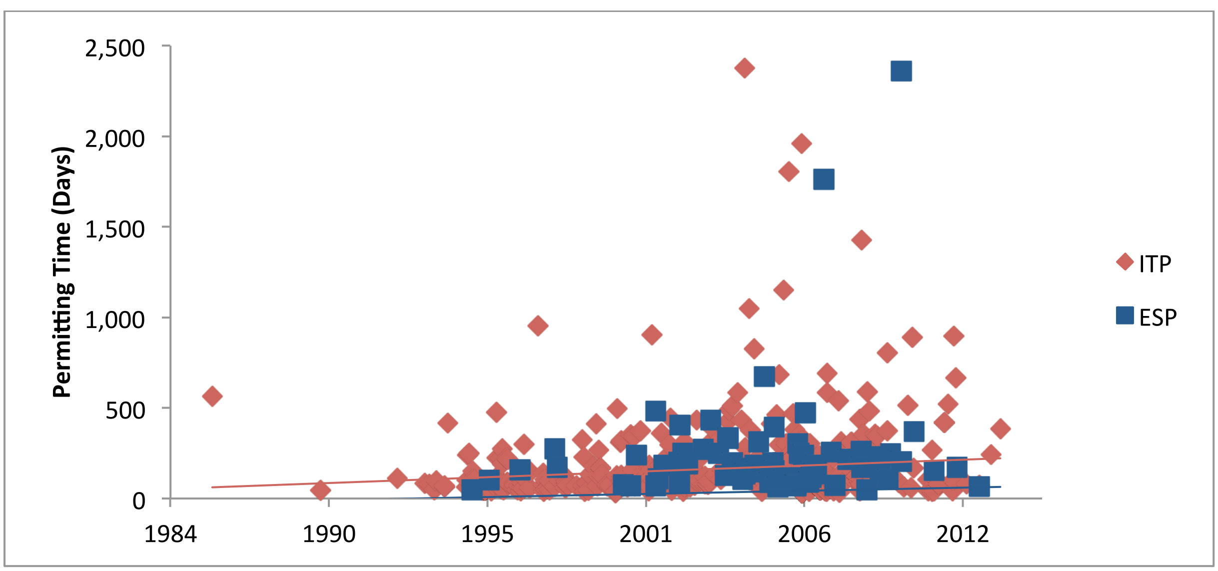


Figure 11. Plan and Agreement Approval Time (in Days).



Note: Linear trend lines are drawn for each plan/agreement type.

Figure 12. Permit Approval Time Plotted Along Number of Permits Approved by Presidential Administration.

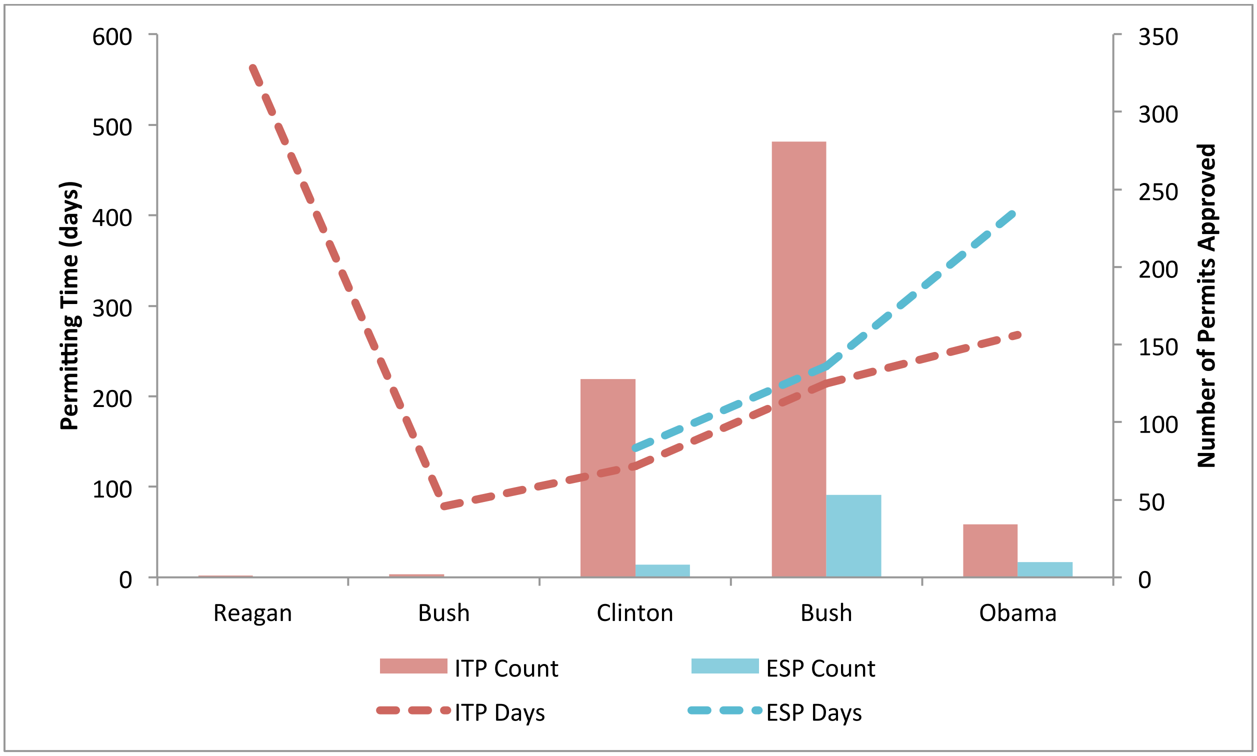


Table 2 contains output from the statistical analysis of permit approval time. Beginning with all variables in the model, the predictor with the highest p-value and rerun is removed incrementally until all remaining predictors are significant. Although all models are significant relative to a null, intercept-only model, model fit is not statistically improved through additional predictors. This finding is evidenced by the non-significant outcome of incremental log-likelihood tests. The final model thus includes only two predictors, *LogLandSize* ($p<0.001$) and *PlanDuration* ($p<0.001$).

Table 2. Model Output for All Model Runs.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Hazard Ratio	P>|z|	Hazard Ratio	P>|z|	Hazard Ratio	P>|z|	Hazard Ratio	P>|z|	Hazard Ratio	P>|z|
CenteredSpecies	0.996	0.408	0.995	0.315	0.995	0.275				
CenteredDuration	0.991	0.000	0.991	0.000	0.991	0.000	0.991	0.000	0.991	0.000
LogLandSize	0.951	0.000	0.944	0.000	0.942	0.000	0.937	0.000	0.943	0.000
NumberLandUse Types	0.974	0.538	0.984	0.691						
PlanType(ITP)	0.752	0.075	0.827	0.193	0.826	0.192	0.794	0.105		
Region2	1.085	0.702								
Region3	1.053	0.881								
Region4	1.372	0.116								
Region5	1.266	0.540								
Region6	1.196	0.467								
Region8	1.292	0.180								
Log-likelihood	-2246.8843		-2249.1995		-2249.2793		-2249.9446		-2251.2133	
Prob > chi2 =	0.000		0.000		0.000		0.000		0.000	
			M1-M2		M2-M3		M3-M4		M4-M5	
Likelihood ratio test			4.6304		0.1596		1.3306		2.5374	
Prob > chi2 =			0.592		0.690		0.249		0.111	

Note: Hazard ratio represents a change in the odds of event occurrence, where the event is permit approval.

Effect size for each variable is reported as a hazard ratio, or the reduction or increase in the odds that the event in question will occur in a given time period after controlling for other covariates in the model. Stated another way, a hazard ratio below one implies that the odds of permit approval are reduced (i.e., longer approval time). Conversely, a hazard ratio above one implies that the odds of permit approval are increased (i.e., shorter approval time). For *LogLandSize*, a hazard ratio of 0.94 is estimated, suggesting that a one unit increase in the log acres of a plan yields a 0.06 reduction in the odds that the plan will be approved in time *t+1*. A hazard ratio of 0.99 is estimated for *PlanDuration*, suggesting that a one-year increase in the length of a plan will reduce the odds that the plan will be approved in time *t+1* by 0.01. These findings could suggest an association between more complex agreements and longer permit approval times, though effect sizes are small and caution should be taken when interpreting their implications.

Though non-significant, general trends in the other predictors can be explored.[2] *PlanType*, for instance, suggests that ESPs (both SHAs and CCAAs) might be associated with shorter approval times; use of ITPs (HCPs) is associated with a reduction in plan approval odds. *CenteredSpecies* and *NumberLandUseTypes* both display hazard ratios below one, again suggesting that an increase in either the number of species or the number of land use types in a plan or agreement could be associated with increased permit approval time. Results for each region are all relative to Region 1 and suggest that permit approval times may differ from region to region. The analysis itself was stratified by administration, owing to its influence on permit approval time (Appendix A), likewise suggesting that federal policy could play a role in the permitting process.

[2] If this analysis were a true enumeration, meaning that it included the entire database of approved plans, measures of significance would be meaningless, because there would be no possibility that the computed hazard ratios were due to chance sampling alone. In light of substantial dataset inconsistencies, however, only those predictors that display the strongest relationship with permit approval time—*LogLandSize* and *PlanDuration*—are emphasized.

Apart from these few observations, it is difficult to draw firm conclusions about the role of plan type and plan complexity on permit approval time. One reason is the condition of the data. Although the Efron tie-break method was used to minimize the influence of ties, their large number in the dataset and the condition of the data may limit what can be said about observed relationships. It is also possible that the statistical models are incorrectly specified.

CONCLUSIONS

Recent policy discussions about the ESA emphasize proactive conservation. Many of these discussions draw from the broad authorizations outlined in Section 10 of the act. A greater emphasis on proactive conservation could therefore facilitate greater use of Section 10 tools.

The collective experience of private landowners with the Section 10 permit process is understudied. Specifically, how does the use of CCAAs and SHAs (so-called enhancement-of-survival permitting) compare with that of HCPs (incidental-take permitting)? Which types of applicants are more likely to use one plan or agreement versus another? How common are multi-species or multi-land use plans and agreements, and how does the permit approval time of these plans and agreements compare with that of less complex plans and agreements? With answers to these questions, regulatory agencies, permittees, and other stakeholders can better identify which plan or agreement is suited to a given applicant type or situation. Moreover, they can develop new or modify existing plans and agreements to address recurrent information gaps or concerns.

The preceding review of the FWS plan and agreement dataset reveals that HCPs are most often used in the southeastern United States, whereas SHAs and CCAAs are more prevalent in West Coast regions. On average, more species are associated with HCPs than with SHAs and CCAAs, though this result could owe to the presence of a few large HCPs. Use of plans and agreements by applicant type is largely intuitive; working lands (agriculture, ranching, and forest management) comprise a larger share of ESPs than development. But the reason for the large difference in plan and agreement use between potentially similar or related activities (e.g., gas and oil production versus utility/infrastructure and mining and extraction) remains unknown.

An interesting and related trend is the minimal cross-over between applicant type and land use type among plans and agreements; with the exception of private individuals and, to some extent, corporations, most applicants and land uses tend to make preferential use of either ITPs *or* ESPs. This finding suggests that attempts to facilitate future multi-applicant, multi-land use agreements *based on existing* Section 10 approaches should not rely on a single framework. Land uses are different, needs vary by applicant type, and species management requirements are diverse and situation-dependent. If the goal is to create approaches that facilitate conservation while lessening risks for both species and applicants, consideration might be given to unifying permitting approaches and reducing divisions among HCPs, SHAs, and CCAAs. Although the existence of multiple approaches increases flexibility, it can also increase the burden of application and review. Moreover, it could create lock-in situations, whereby familiar paths are chosen at the expense of less familiar ones with greater potential benefit.

Previous research suggests that plans covering relatively large land areas and numbers of species have relatively greater conservation effectiveness (Langpap and Kerkvliet 2012). This report suggests that more complex plans—especially those that affect larger land areas or that have longer durations—could be associated with longer approval times. The finding that presidential administration plays a strong role in the length of time between initial permit notification and final issuance, however, warrants further investigation. The existence of administrative processes capable of facilitating permit approval could help promote the use Section 10 approaches should these approaches be emphasized in the future.

Although exploratory, this analysis can inform current environmental policy discussions by helping to identify patterns of both historical plan use and administrative burden associated with plan approval. It also points to the value of conducting assessments with additional predictors and explorations of alternative data sources and statistical techniques to minimize or remove violations of key assumptions. Future research could also explore complete permitting time, comprised of both the formal permit review and informal discussion and negotiation between permittee and regulatory agency. If the objective is to address the barriers to greater use of Section 10 permitting programs, this informal stage of the permit approval process must be better understood.

APPENDIX A: DETAILED STATISTICAL METHODOLOGY AND OUTPUT

For all iterations of the model, model fit estimates and coefficient hazard ratios are generated and reported, as are regression coefficient correlation matrices to assess for multicollinearity and DFbeta values to identify potential outliers.

None of the variables used in this analysis are time variant, allowing for a time-invariant Cox regression model. Given the large number of ties (379), the Efron tie-breaking method is selected for the model. The analysis begins with *PermittingTimeDays* as the dependent and *Status* as the status variable. The FWS database includes only approved plans, so all plans have the same status. As discussed by Garson (2013), a lack of variance in the status variable does not present a problem, as it is the time-to-event variable (*PermittingTimeDays*) that is of interest. There are no left- or right-censorsed cases in the data. Analysis of total permit application time, which would include both preliminary discussions and the formal approval period assessed here, would result in some unknown number of cases being left-censored given the present dataset.

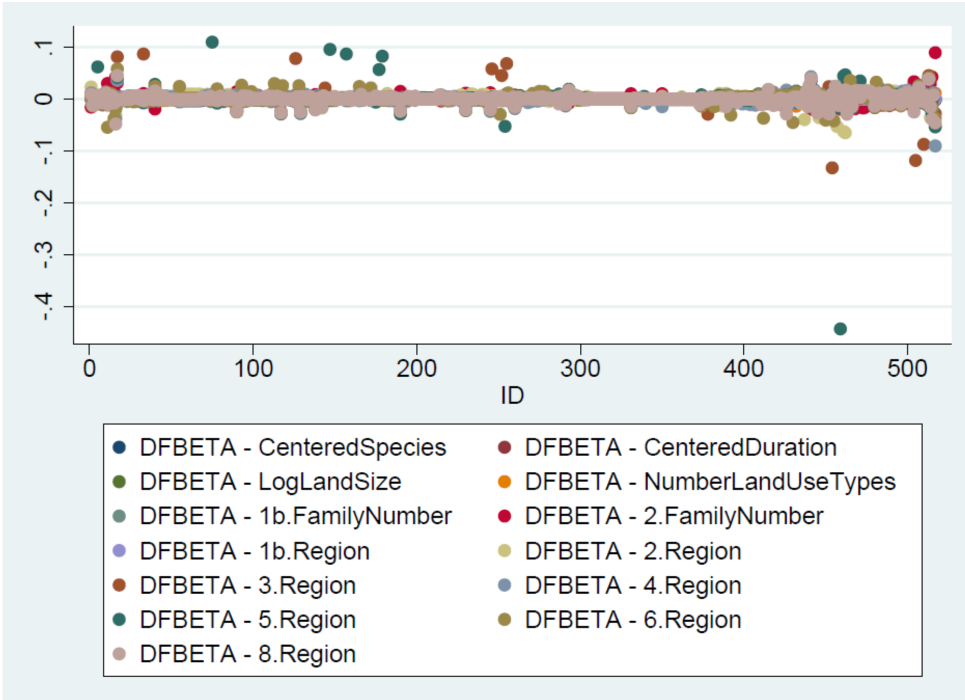
A test for potential violations of the proportional hazards assumption is conducted prior to running the model. Assessment of categorical variables for violation of proportional hazards assumption (see, Kleinbaum and Klein 2005) reveals that *CollapsedAdminIssued* is the only statistically significant categorical variable (Table A1). Accodingly, the analysis employs a stratified Cox regression model, stratifying by *AdminIssued* and including all other variables listed in Table A1.

Table A1. Test of Proportional-Hazards Assumption for the Original Model (All Predictors).

	rho	chi2	df	Prob>chi2
PlanType	0.007	0.02	1	0.881
Region	-0.067	2.27	1	0.132
CenteredSpecies	-0.013	0.12	1	0.735
CenteredDuration	0.198	20.93	1	0.000
LogLandSize	0.010	0.05	1	0.826
NumberLandUses	0.044	1.01	1	0.314
AdminIssued	0.177	19.35	1	0.000
	global test	43.56	7	0

Following each model run, the analysis generates a correlation matrix of coefficients for each model run to assess multicollinearity. Assuming a critical value of 0.85, it finds no incidence of high correlation across predictors. The analysis likewise assesses the data for outliers. Assuming the critical value formula for DFbeta to be $2/\sqrt{n}$ (Pevalin and Robson 2009), where $n = 517$ for all models, the analysis estimates a critical value of 0.087, against which it identifies several potentially influential cases in model 1 (Figure A1). A check of the underlying dataset suggested no errors in entry or coding for these records. Because the values reflect true observations, the cases were retained in the analysis. Values in all other models are well below the critical value for all cases.

Figure A1. Plot of DFbeta Values by Randomly Assigned Case ID for Model 1 (All Predictors).



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