Final Memorandum

Development of a SECAS Conservation Decision Guidance Library

ADMINISTRATIVE:

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Principal investigators:

Nils Peterson
Department of Forestry and Environmental Resources
North Carolina State University
919-229-9519
nils_peterson@ncsu.edu

Fred Cubbage
Department of Forestry and Environmental Resources
North Carolina State University
919-515-7789
fred_cubbage@ncsu.edu

Project fiscal contact:

Matt Ronning
Associate Vice Chancellor
Research Administration/SPARCS
2701 Sullivan Drive
Admin Services III; Box 7514
Raleigh, NC 27695-7514
(919) 515-2444 - phone
(919) 515-7721 - fax
sps@ncsu.edu

Other cooperators and partners: John Tirpak; Rua Mordecai; SECSC staff

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PUBLIC SUMMARY:

We examined the decision making context, decision making process, and management planning associated with the restoration of open pine ecosystems in the Southeast. To better understand the planning practice associated with this system, we assessed the quality of 35 management plans from federal, state, and nongovernmental agencies. We found that newer plans scored higher than older plans, suggesting agencies may be learning to develop better plans over time and indicating older plans should be prioritized for revision. Plans from federal and state agencies scored higher than plans from nongovernmental agencies, reflecting differences in agency missions and resources. The fact base scored high across most plans, whereas actions and implementation scored lower. Although agencies tended to perform best on fact base, our results suggest having a strong fact base has little influence on other components. To improve actions and implementation, planners should consider incorporating more stakeholder participation to help them develop better actions and implementation indirectly through improved problem and objective statements.

We also investigated how decisions were being made and what barriers – if any – faced decision makers. To gain this insight, we conducted 24 semi-structured interviews with key decision makers and stakeholders and our findings emphasized the challenge of collaboration between individuals, governmental and non-governmental organizations. We found discrepancies between groups on everything from objectives and goals, to how decisions are made, the barriers groups are facing, information that is used to make those decisions and where information comes from as well as differences in decision making timing and frequency. Agency managers had firm objectives while landowners/private land managers had flexible objectives that changed based on new goals, knowledge and information. In the same vein, agency managers said it was hard to change their management plans but landowners/private land managers said that their management plans were constantly changing to meet their shifting objectives. Agency managers reported that they had access to all of the information they needed to make "good" decisions while landowners/private managers said that they wanted and needed more information, specifically better economic and growth data. And although agency managers said climate change was a factor when making decisions, landowners/private land managers said that climate change was not a decision making factor. To bridge the gap between the two groups and increase information sharing, a library of regulatory requirements, scientific data, personal experiences and fiscal information may be a way to align management objectives and goals.

Lastly, we developed a questionnaire that may be used in future research projects to evaluate how socio-structural drivers and the personas of decision makers influence their decision making.

TECHNICAL SUMMARY:

We presented a case study on planning and decision making associated with the restoration of open pine ecosystems in the Southeast. The restoration of longleaf pine ecosystems is a complex natural resource problem and will require high-quality planning and decision making to guide successful restoration efforts. Longleaf pine dominated the Southeast's coastal plain in colonial times, covering up to 90 million acres, but due to agriculture conversion, overharvesting, conversion to other pines including loblolly, fire suppression, and urbanization, only 3.4 million acres remain today. These ecosystems typically exist in isolated fragments on public and private land throughout the Southeast, and a multitude of actors including federal and state governments, nongovernmental agencies, and the private sector own and manage these ecosystems. These stakeholders have developed many individual agency and cooperative plans, incorporating their own values and missions into restoration goals, which results in a range of conflicting objectives and management actions. Agencies have unique institutional histories and operational contexts (e.g. number of acres, operational missions, resources available) that factor into the quality and effectiveness of their planning and management efforts.

We aimed to gain a better understanding of the management decision context, planning practice and the role and quality of management plans, and decision making processes across the Southeast. To do so, we evaluated the quality of management plans, conducted interviews with decision makers, and developed a questionnaire (appendix 1) on the decision making process and climate change perceptions that may be deployed in the future. The results of this project will provide insights for the conservation of open pine systems and other related high priority conservation contexts that the Southeast Climate Science Center and Southeast Conservation Adaptation Strategy team hope to explore in future efforts.

To assess the quality of management plans, we developed a plan evaluation tool (appendix 2) based on components of the rational-comprehensive planning model (e.g., definition of problem, objectives and actions) and key innovations intended to address wicked problems which are: adaptive management, collaboration between agencies, and stakeholder engagement. We used this tool to evaluate and compare 35 management plans from federal, state, and nongovernment groups managing longleaf pine ecosystems in the Southeast United States using five components that influence plan effectiveness: (1) problem and objective statement, (2) fact base, (3) actions and implementation, (4) integration with other plans, and (5) stakeholder participation. We proposed a model for understanding the relationships between planning components and tested two other hypotheses: (1) we expect the quality of plans to improve over time as agencies learn and improve from previous planning efforts; and (2) because the resources available and constraints faced by each agency vary given each agency's specific institutional and planning contexts, we expect plan quality to vary by the type of plan and agency producing it.

The tool was an effective means to provide an objective assessment of the management plans, with high intercoder reliability. We used structural equation modeling to test a model for understanding how plan components affect each other, and our results largely supported the theoretical model predicting structural relationships among plan evaluation components. More stakeholder participation during the planning process was positively related to plans having a well-defined management problem statement and objectives targeting the problem and to plans being integrated with other plans. A good problem and objective statement, in turn, predicted plans having clear action and implementation protocols. Fact base did not significantly influence either problem and objective statement or actions and implementation, so we excluded this category from the final model. Plans generally scored high in fact base and integration with other plans but scored poorly on strategic elements such as actions and implementation. Results from a regression analysis indicate newer plans generally scored higher than older plans, suggesting agencies are getting better at planning to address complex challenges. Using an analysis of variance test, we found that plans from federal agencies scored higher on average than state and nongovernmental agency plans, reflecting differences in agency missions, cultures, and resources.

The semi-structured interviews with agency managers and private landowners/managers provided a more comprehensive insight into what influenced decision making. We used a naturalistic qualitative methodology as it lends itself to illuminating previously unexplored practices and experiences. We conducted 24 interviews and used snowball sampling, asking each informant for new possible interviewees, until the suggested informants were being repeated. Interviews were conducted over the phone, and were recorded on a phone application with permission from the interviewee. Transcripts were analyzed using thematic content analysis (Anderson, 2007) allowing themes to develop from the data. Our results demonstrate the clear differences between how agency managers and landowners/private land managers make decisions and how those decisions are informed.

	Agency managers	Landowners/private land managers
Objectives	Set, unchanging	Flexible, adaptable
Management plans	Fixed	Changing based on new information
Information	Had access to information needed to make decisions	Wanted more information in order to make decisions
Climate change	Was a decision making factor	Was not a decision making factor

PURPOSE AND OBJECTIVES:

The objectives of this project were to (1) develop a better understanding of the management decision context for important SECAS resource management themes using restoration of open

pine ecosystems as a case study; (2) describe and synthesize management objectives related to this resource management theme; (3) improve understanding of how management decisions are being made and how this decision making process can be improved; and (4) design a questionnaire to evaluate socio-structural drivers of decision making associated with SECAS... To achieve objective 1, we assessed the quality of management plans, and as part of this effort, we identified whether management objectives were included in the plans. We synthesized the management objectives from 15 plans, sampled from the plans used in the evaluation, and identified common themes to achieve objective 2. We conducted interviews with decision makers in the region to achieve objective 3. We used information gained in these efforts to inform the development of the questionnaire.

ORGANIZATION AND APPROACH:

Because the objectives were interrelated pieces, we addressed them simultaneously. We will first describe the methods used to evaluate management plans and then describe methods used in the interview process.

Management Plan Evaluation Methods

We compiled a list of federal, state, military, and nongovernmental agency plans that were publically available and provided direction about the management of longleaf pine ecosystems. The list included 71 plans from the U.S.D.A. Forest Service (n=10), U.S.D.I. Fish and Wildlife Service (n=28), Department of Defense (n=3), America's Longleaf (n=1), Nature Conservancy (n=9), Joint Ventures (n=3), and state natural resource agencies (n=17). A stratified sample of 35 plans was selected from the population of 71 plans. The sample included the 1 plan from America's Longleaf, 2 plans from the Nature Conservancy, 3 plans from the Department of Defense, 3 plans from Joint Ventures, 4 State Forest Action plans, 4 State Wildlife Action plans, 12 plans from the Fish and Wildlife Service, and 5 plans from the Forest Service.

We conducted an assessment of management plans using a plan evaluation tool designed by our research team. We developed a plan evaluation tool based on approaches developed by Berke (1994); Berke, Crawford, Dixon, and Ericksen (1999); Berke, Godschalk, and Kaiser (2006); and Brody (2003), which provided a blended qualitative and quantitative approach to assess the quality of management plans. The tool allowed us to assess the strength of specific plan elements, and then allowed statistical analysis of those ratings. We calculated the total plan evaluation score using a series of questions that measure indicators in each of the five categories: (1) problem and objective statement, (2) fact base, (3) actions and implementation, (4) integration with other plans, and (5) stakeholder participation. The possible coding responses were scores of 0, 1, or 2. The responses were categorized as 0= not identified; 1= identified, vague; and 2= identified, detailed, relevant, clear.

We pretested the protocol to ensure reliability in the plan evaluation. A team of two graduate students independently tested the same plan and compared results. We revised the evaluation tool

after discussing unclear questions and coding disagreements, and we then repeated the pretesting process. The coders working independently evaluated a subset of 15 plans from the sample. Using the results from those evaluations, we calculated percentage agreement and intercoder reliability (Cohen's kappa). The percentage agreement score was 86%, and the Cohen's kappa reliability score was 0.72. After testing the tool and ensuring acceptable intercoder reliability, one coder evaluated the remaining 20 plans.

The total evaluation score for each category was calculated by summing the scores from all indicators. Category scores varied depending on the number of questions in the category, so we standardized the scores. We divided each category score by the total possible score for that category and multiplied by 100, so scores ranged from 0 to 100 for each category. The total evaluation score for each plan was calculated by summing the raw scores from the five categories, dividing by the total possible score, and multiplying by 100.

We used analysis of variance (ANOVA) with Tukey's post hoc analysis ($\alpha<0.05$) to test for differences in plan quality among plan types. We then grouped evaluation scores by federal, state, and other (nongovernmental and regional partnerships) agencies and performed an ANOVA to test our hypothesis that federal agencies produced higher scoring plans than state and nongovernmental agencies.

We conducted regression analyses on total evaluation score as a function of plan implementation year to test whether overall plan quality improves over time. We also conducted regression analyses for each category score as a function of plan implementation year, using separate models for each category.

We proposed a model for understanding how each of the five planning components we evaluated relates to each other, and we evaluated relationships between plan components using structural equation modeling (SEM). We developed the model in STATA SE version 12. We measured goodness of fit for the model using standardized root mean square residual (SRMR) and R^2 measures.
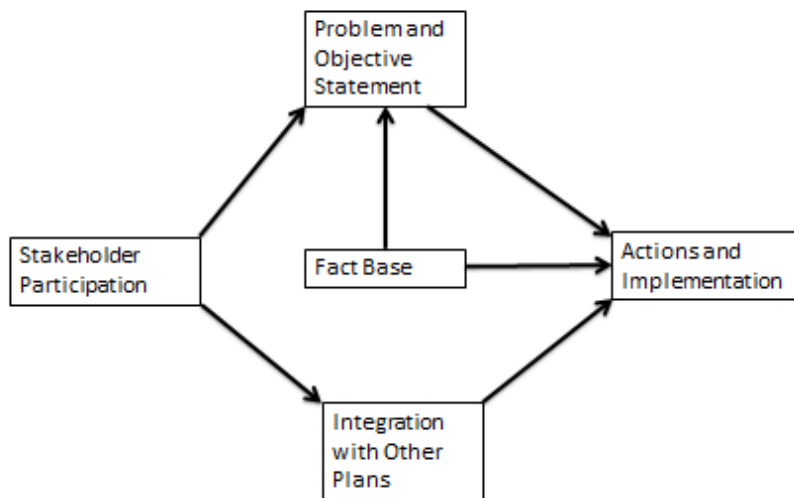
Interview Methods

We used a naturalistic qualitative approach in our study. This methodology treats the narratives from each informant as data, allowing themes to emerge from stories and experiences (Lincoln & Guba, 1985). We conducted 24 semi-structured interviews with decision makers and stakeholders. We used snowball sampling and began with two key informants, who had first-hand knowledge of the community as well as the issues facing it. We then asked each subsequent informant to suggest others who would be able to provide input, until the same names were being suggested. We had 10 informants who were from federal, state and local agencies, and 14 private landowners and managers. Interviews were conducted over the phone, lasted from 20 minutes to 2 hours and were recorded on a phone application with permission from the interviewee. Interviews were then transcribed for analysis. Although informants were allowed to determine the direction of the interviews, we used 12 interview prompts (appendix 3) to determine what barriers were facing those who managed or were advocates for longleaf and how those barriers influences management decision making.

Data was analyzed using MaxQDA qualitative data analysis software (MAXQDA, software for qualitative data analysis, 1989-2015, VERBI Software – Consult – Sozialforschung GmbH, Berlin,Germany) and thematic content analysis (Anderson, 2007). We began by sorting our data from the transcripts into broad categories that illustrated a single coherent thought or theme, and then developed those themes by looking for relationships within the themes, searching for opposition among themes, and developing thematic hierarchies. We use the following citation format to identify quotations from interviews: Informant, Interview number. For example, a quotation identified as: I3 was spoken during interview number 3. We've outlined major themes as well as subthemes and indicated in parenthesis how many times each theme emerged.

PROJECT RESULTS:

The raw and standardized evaluation scores for each plan are presented in tables in excel spreadsheets submitted along with this report. The plan evaluation tool, management plans, interview transcripts, and preliminary questionnaire were also submitted along with this report.

Management Plan Evaluation Results

We evaluated 35 plans implemented between 1996 and 2014. The total standardized evaluation scores ranged from 41.9 to 86.5. The mean total evaluation score was 68.9, and the mean category scores for each agency type (federal, state, and other) and for all plans (shown in the means row) are presented in the table below. Our results indicated that plans from federal and state agencies scored significantly higher than plans from nongovernmental agencies and the Joint Ventures.

Agency Level	Problem & objective statement	Fact base	Actions & implementation	Integration w/ other plans	Stakeholder participation	Total
Federal	76.9	88.4	52.6	83.3	77.6	73.6
State	61.6	96.4	42.5	100	87.5	69.1
Other	58.3	77.4	22.2	41.7	58.3	52.3
Mean	70.2	88.4	45.1	80.0	76.6	68.9
Std. Deviation	14.2	14.5	18.2	34.2	36.0	12.9

We found there was some variability in quality by plan type. Plans from the U. S. Fish and Wildlife Service scored higher (mean=79.4) than state forest action plans (mean=68.2), Forest Service plans (mean=61.7), Joint Venture plans (mean=55.4), and NGO plans (mean=49.1). Department of Defense plans (mean=74.3) and state wildlife action plans (mean=69.9) scored higher than Joint Venture and NGO plans.
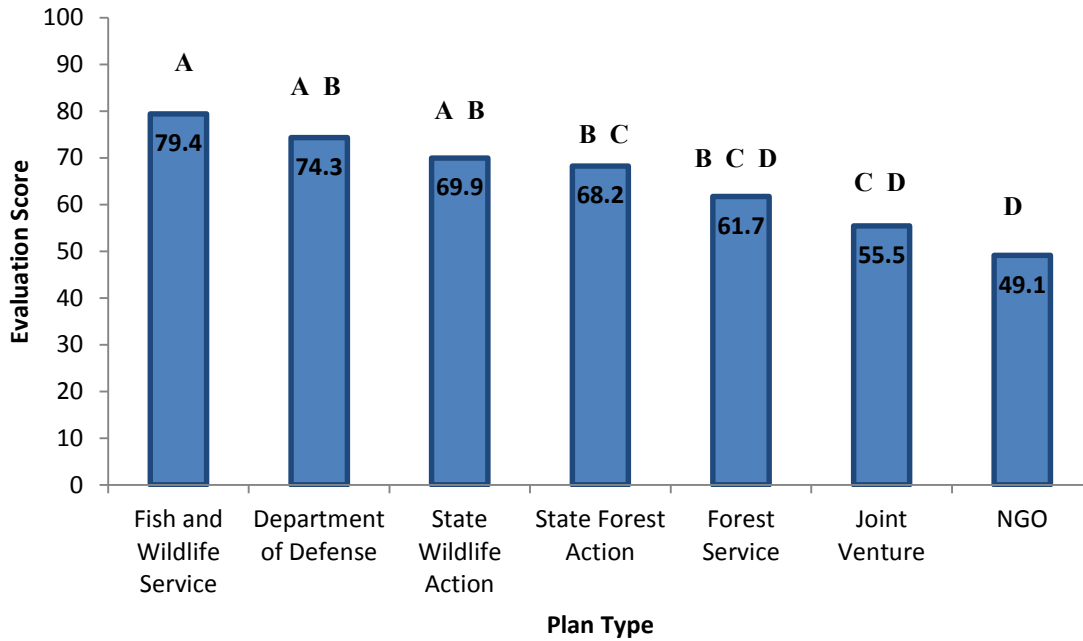
Regression analysis indicates that the year the plan was implemented was a positive predictor of total evaluation score (p= 0.018, R^2 = 0.158), indicating that older plans generally scored lower than newer plans. The regression analysis resulted in the following regression equation: $Y = -2576.486 + 1.318x + \epsilon$. Implementation year was also a positive predictor of score in the problem and objective statement, fact base, integration with other plans, and stakeholder participation categories. Scores for the actions and implementation category decreased over time; however, this result was not significant (p=0.0883).

Planning Scores	Intercept	β	P	R^2
Total	-2576.486	1.318	0.018	0.158
Problem & objective statement	-2387.100	1.225	0.049	0.113
Fact base	-3696.674	1.997	0.002	0.257
Actions & implementation	2779.381	-0.063	0.088	0.086
Integration w/ other plans	-8756.387	4.404	0.002	0.252
Stakeholder participation	-8707.102	4.378	0.004	0.225

We proposed and tested a model for understanding how planning components relate to each other, and our results largely support our proposed theoretical model. More stakeholder participation during the planning process was positively related to plans having well-defined management problem statement and objectives targeting the problem and to plans being

integrated with other plans. A good problem and objective statement, in turn, predicted plans having clear action and implementation protocols. Since fact base did not significantly influence either problem and objective statement or actions and implementation, we excluded this category from the final model.

Model goodness of fit statistics:
SRMR= 0.085
Overall R^2= 0.371
*p<0.10 **p<0.05 ***p<0.01
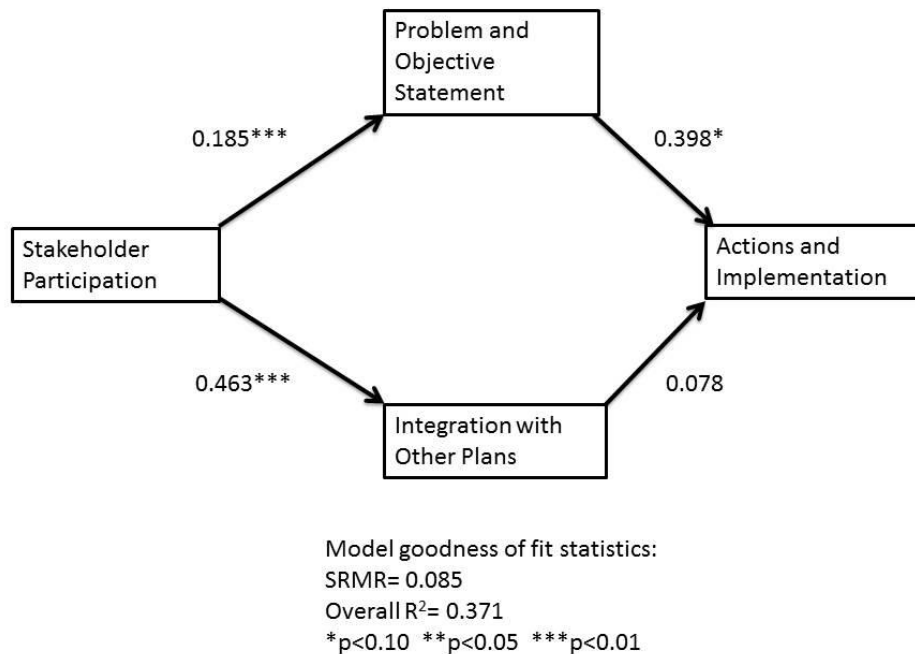
Decision Maker Interview Results

As part of the development of a SECAS Conservation Decision Guidance Library, we wanted to gain more complete understanding of what influences decision making, while finding out what, if any barriers, managers face while making decisions. We asked informants to describe open pine system and to outline the challenges facing those who manage these systems. Informants described open pine systems in the South Eastern United States as being areas with "longleaf pine, where you could see for 200 yards. Historically you could ride a horse-drawn wagon anywhere through the pinelands because it was so open, it was so burned (I15)." The two greatest challenges facing the open pine systems were described as the "decline of prescribed fire – or in the fire culture. That's been a big challenge, (and) whether it's because of liability or certification – land ownership is becoming smaller (I1)."

We then asked informants to describe:

1. What are your open pine ecosystem management objectives and how are objectives determined?
2. What information do you need to make good decisions? Do you have this information? What information do you wish you had? Is it available? Where?
3. Is climate change a consideration?

Our findings showed a clear difference between agency managers and landowners/private land managers.   The two groups had different objectives and goals, they worked with different information, on different timelines and had different protocols for making changes. Because of these differences, groups faced varying barriers. Agency managers often worked with set, mandated objectives and with long term management plans that were difficult to change but they reported that the information they need to make decisions was available and being well shared through a variety of outlets within agencies, although many did mention that there could be better sharing with actual land managers. Landowners and private land managers had conflicting responses. They said that the greatest barrier they faced is that the information they need to make informed decisions isn't always available but their management plans are constantly being revised based on what they do learn.   We also asked if climate change concerns were a consideration in decision making. Again, we saw a clear difference between the two groups, with agency managers stating that climate change was a factor and landowners/private land managers stating that it was never a consideration.

Objectives and goals

- Agency managers had set, mandated goals that were difficult to change.

  o We were commissioned to conserve and protect the game species of the state. (i1)
  o Our big tasks is to keep up with all the records of where plant and animal occurrences across the areas that we serve (i12)
  o My agency wants to focus a lot more on endangered species or threatened species or at risk species… Our primary objectives…don't change very often. (i11)

- Landowners/private land managers had flexible objectives that changed based on new information.

  o I've never met a landowner that's not willing to be flexible and adapt. Never met anyone like that. (i1)

- o I'm in the process of reviving mine (management plan) you know we're continuously looking at the management objectives and agreeing on what to do…well you have to be flexible, certainly have to be flexible because I mean if you don't make it to be flexible just wait until Katrina hits you and you've got to start all over. (i4)
- o Do objectives change based on information that's gathered? Yes, definitely. (i15)

Management plans

- Agency managers found it hard to change their management plans.

- o Again, it's just getting on the right path and then kind of with expectations that we'll stay on that path. (I11)
- o It's very hard for it (the agency) to adjust and adapt. (i13)
- o Like I said before about the big organization, it really hasn't that sort of revisiting dynamically changing goals. It's a very long process. (i6)

-Landowners/private land managers worked with adaptable management plans.

- o I've never met a landowner that's not willing to be flexible and adapt. Never met anyone like that. (i1)
- o I update my plan on a regular basis. A very good friend of mine, he's always rewriting and updating his new plans. (i3)
- o (Management strategies) are very much (dynamic). (i7)
- o Well, you know, when you go out on the property and you work the property, everything changes from season to season and year to year. It's never the same. (Making decisions) is incremental (i8)

Information sharing

- Agency managers reported having access to information they needed to make good decisions.

- o We've got the resources if there's something I don't know or don't have access to, we have such a good network of partners, basically, that we can usually get that information. (i1]
- o We also share the data and results. We do have information portals that we can control whether or not the records are publicly visible versus internal, and we do try and post a lot of the raw data and information and again let people, at least especially in the (agency), know about it so if they want to do more analysis and interpretation of the data we have collected, that they have that freedom and ability to do so. (i5
- o There's a lot of information out there (i12)

- o I would say because of how high profile and how connected so many people are on this issue, there's way more information sharing across – within levels and across levels in this system than there is any other ecosystem or for most other issues that I can think of in the Southeast. (i13)

- Landowners/private land managers reported not having access to all information they needed and/or wanted.

- o There's not enough literature, not enough training, and not enough information shared…if we had access to more research, more data, more information, and we have the ability to create more mechanisms for distributing that information it would make the job of winning people over to longleaf easier I think and it would make the job of getting things done on the ground easier. (i2)
- o I mean I share information, but honestly the actual growth and yield models I think there's still a lot of work to be done on longleafs, especially longleaf plantations. So I don't know that I have real good data there. (i4)

- *Landowners/private managers wanted more economic data:*
  - o There just hasn't been much research and analysis done in that area (finance and economics) again because in the south everything has centered around production forestry and that does not include longleaf, but it should…we still have a long way to go so that all of the detailed information about the issues related to the regeneration of longleaf stands gets into the hands of the people that really, really need it. (i2)
  - o So we don't have the financial models, we don't have good growth of needle data, we don't have all of the information available on a financial basis that we do for other species. That's the biggest shortage and what little bit is out there is not well disbursed, so that's one.
- *Landowners/private managers wanted better growth data:*
  - o Where the real issues are and where we really still need research is in the containerized seedlings. (i4)
  - o Better growth and yield data. The growth and yield models. (i7)
  - o Another area (more information is needed) is in longleaf regeneration. (i10)

Climate change

- Agency managers said climate change was a factor when making decisions.

- o (Climate change is) increasingly (becoming an important factor in decision making. (i5)
- o Yes, I do (consider climate change). (i8)
- o I mean there's definitely discussion about it (climate change). (i13)

- o It is. It's a main base now. In the last five years, the Forest Service mandated that climate change be considered in all management decision-making. (i14)

- Landowners/private land managers said that climate change was NOT a decision making factor.

  - o No, that never really comes up…We try to leave out – because climate change is still pretty political in this part of the world, it's not really – I feel like if we bring it up, it's gonna kind of close a door. (Climate change is) – definitely (polarizing). (i1)
  - o Most old men do not believe in climate change, I can tell you that. I'm not helping people manage land for polar bears...so, that and religion, I just don't talk to people about. (i3)
  - o I don't think climate change is going to change any decision that I may make in my lifetime, because frankly I think we've always had various cycles and I'm sure these longleafs to have been the predominant tree in the southeast they've seen many climate changes. Now I can't say they haven't seen drastic, but they've seen drastic rises in temperature like some people might predict, but I'm sure they've seen the rise in some temperature and if frankly if you had a rise in temperature all you'd probably see is an extension of the longleaf ecosystem farther to the north, which might not be a bad thing it has very little bearing on my day-to-day decisions. I'd say I'd put it at zero bearing frankly (i4)
  - o It's indirectly related to climate change, but not many people are talking – you know, that's a loaded word. (i15)

ANALYSIS AND FINDINGS:

We found that the plan evaluation tool we developed provided a useful way to objectively assess the quality of many types of agency plans. Our results indicate that improving stakeholder participation likely positively impacts developing good actions and implementation protocols indirectly through improved problem and objective statements. Although fact base is often a major focus of planning efforts and what agencies tended to perform best on, we found it had little influence on other planning components. Our results indicate that efforts to improve longleaf pine planning should focus on state and nongovernmental agencies, who in general scored lowest in our evaluation, and older plans should be prioritized for revision. Our evaluation of management plans helped us completed the first project objective.

Interviews results reinforce the fact that there are distinct differences in land management objectives facing the South Eastern United States. We saw agency managers and private landowners/managers were on opposite ends of the spectrum when talking about objectives, goals, and decision making timing and frequency. They also had differing views on information access and the importance of climate change. Agency managers revealed that their goals and

management plans were not flexible, while private landowners/managers said that their management strategies are constantly in flux. Agency managers informed us that they had access to the good decision making information but landowners/private managers said that they were lacking access to information they needed and were particularly interested in economic and growth data. The two groups also had different views on climate change, with climate change being a decision making factor for agency managers but not a consideration for private landowners/ land managers. These findings highlight fundamentally different decision processes between agencies and private landowners/managers, and emphasize the need to bring scientific (e.g. climate change findings, growth models) and economic knowledge effectively into the decision making process outside of the agency setting. These semi-structured interviews address the second and third objectives of the project.

We produced a draft questionnaire on the socio-structural drivers of decision makers, the decision making process, and climate change perceptions that can be used to determine the various personas of natural resource decision makers.

CONCLUSIONS AND RECOMMENDATIONS:

The evaluation of longleaf pine management plans and plan components provided useful insights about what characteristics led to high quality plans and which agencies produce better plans. The formal plan evaluation tool developed in this study had high intercoder reliability and may provide a useful plan evaluation tool in other forestry and natural resource planning contexts. Our results indicate that these plans were generally quite good, especially in the fact base component, and plan quality improved over time. Although fact base is often a major focus of agency planning efforts and what agencies tended to perform best on, it may have little influence on actions and implementation. Our results expand previous research by identifying a potential pathway by which engaging with stakeholders positively impacts other aspects of the planning process. While engaging stakeholders does not ensure that clearly articulated set of actions are developed, stakeholder engagement may improve action planning indirectly through better definition of problem and objective statements. Efforts to improve longleaf pine planning should focus on state agencies and nongovernmental organizations whose plans tended to have lower scores in the evaluation, and who have the most limited resources for high quality plans. Because longleaf pine plans are improving over time, older plans should be prioritized for revisions.

Future research should attempt to link plan quality to success in achieving goals and objectives to ensure that plans address management problems and meet management needs of the agency. Similarly agencies should develop strategies to better integrate insights from planners and those implementing the plans during the planning process. Many plans included poorly established goals, objectives, and actions, which may present challenges during implementation. Future research should also explore how the planning context affects the quality of plans. A lack of resources including staff, budget, and time as well as resistance to change and lack of collaboration due to political or historical barriers serve as confounding factors that may prevent

high scores and may make implementation more difficult. Last, future work could investigate if and how agencies are using findings from plan evaluation studies to improve planning. Although the natural resource governance is tremendously complicated and influenced by several factors, developing high quality planning is an essential tool for ensuring that agencies address natural resource problems, engage with stakeholders and other agencies, and implement actions that work towards achieving objectives.

Because of the limited duration of this project, we were only able to complete an analysis of management objectives from a subset of plans (15 plans). We found that objectives were targeted to maintain, create, or restore longleaf pine. Objectives fell into four main themes: habitat and species, fire, administration and collaboration, and public engagement. We recommend further analysis of management objectives from a larger sample of plans as a next step.

Interview results indicate a need to better disperse information to private landowners and managers. The research and information that is being developed in the agency setting is not currently reaching stakeholders. Consolidating information into an easily accessible library of regulatory requirements, scientific data, personal experiences and fiscal information may be a way to reach a wider group of people.

Further development and use of the questionnaire are additional recommended next steps. The questionnaire could be used to assess the decision making process, social networks, and climate change perceptions of decision makers. Defining decision-making personas can help illustrate how these characteristics impact individual decision-making processes, and relevant dimensions for defining personas may likely include: spatial, temporal, collaboration style, approach, and driving force. Information from the questionnaire may be used to inform planning processes.

MANAGEMENT APPLICATIONS AND PRODUCTS:

We worked with administrators and decision makers at the SECSC and the South Atlantic LCC, and the SECAS Governance group as well as various non-profits and governmental organizations. Dr. Jerry McMahon from the SECSC played an important role in advising the development of the plan evaluation tool and the design of the project. Rua Mordecai and John Tirpak from the LCCs, as well as Robert Abernathy, President of the Longleaf Alliance, Steven McNulty, Director of the USDA South East Regional Climate Hub (SERCH), Clay Ware with the US FWS, and Troy Ettel of the Nature Conservancy, provided support during the development of the interview question design and sampling protocol. Greg Wathen, head of the SECAS Governance Essential Work Area group supported this project and provided opportunities to discuss findings and communicate results to a larger audience of relevant agency decision makers.

Several products resulted from this project: articles describing management plan evaluations and the decision making context and process, transcripts and qualitative analysis associated with

decision maker interviews, and a preliminary questionnaire for evaluating socio-structural drivers of decision making associated with SECAS, decision making process, and climate change perceptions. These products form the SECAS decision guidance library that sheds light on the decision context for open pine ecosystem management at the landscape scale in the Southeast and improves understanding of how management decisions are made and how these decisions can be improved. The library will be available on the USGS data repository and on the NCCWSC Science Base website.

We expect the findings from our plan evaluation may encourage agencies to revise plans more frequently and may guide them to focus less on collecting data and more on carefully forming objectives and goals and engaging stakeholders. Our results may also inform the development of state wildlife action plans and state forest action plans, potentially contributing to the format and focus of planning efforts. Based on our findings, agencies should engage with stakeholders early on in the planning process, and defining the management problems and objectives should also be a priority early on to support the development of effective action plans. Additionally, our results may encourage agencies to consider how the plan quality is linked to goal achievement and how plans are used in on the ground management scenarios. Regional efforts, such as those being conducted by SECAS governance group, may find the results of our path analysis to be useful in development planning guidance for agency stakeholders.

Our results showed that agency managers have the information needed to change goals and objectives but don't have the ability to change their plans based on the information available, while private landowners and managers have the ability to change their plans but don't have the information they need to inform their decisions. Our results may show agencies managers that decision making protocols needs greater flexibility and timing and they might begin to share more information with private landowners and managers, especially findings regarding climate change, economic data, or growth models.

Interview results indicate a need to better disperse information to private landowners and managers. The research and information that is being developed in the agency setting is not currently reaching stakeholders. Consolidating information into an easily accessible library of regulatory requirements, scientific data, personal experiences and fiscal information may be a way to reach a wider group of people. Information about the library could be spread by well known organizations such as the Longleaf Alliance.

The questionnaire is intended to evaluate how the personas of decision makers influence their decision making. The results of the questionnaire may help us understand the variety of individual and societal characteristics that influence how people utilize information in decision making and planning processes. Further, findings from the questionnaire may be used to help tailor plans to capitalize on the strengths of natural resource agencies and decision makers and to ensure plans are relevant to their needs and priorities.

OUTREACH:

The study results have been communicated to managers, decision-makers, and the public through research articles, conference presentations, a webinar to the SECAS Governance group and a project planning meeting with researchers from the University of South Carolina, North Carolina State University, and the Southeast Climate Science Center. . The management plans, plan evaluation tool, evaluation scores, interview transcripts, and publications will be publically available in the USGS Repository and on the NCCWSC Science Base. Work completed for this project contributed to a master's thesis and will contribute to a PhD dissertation, and these documents will be available through the NCSU Electronic Thesis and Dissertation Repository. A list of the types of outreach we conducted as part of this project is below.

Articles:

- Under review: Meta-Analysis of Landscape Conservation Plan Evaluations- Journal of the Southeast Association of Fish and Wildlife Agencies
- In preparation: Evaluation of Natural Resource Planning in Longleaf Pine Ecosystems- Journal of Forest Ecology and Management
- Accepted: NA
- Published: NA

Presentations:

- Conference Presentation at the Southeast Association of Fish and Wildlife Agencies Conference
    - Clark, K., Foster, M., F. Cubbage, J. McMahon, and M.N. Peterson. Meta-Analysis of Landscape Conservation Plan Evaluations. Southeast Association of Fish and Wildlife Agencies Conference. Asheville, NC. 1-5 November 2015.

- Webinar Presentation for the SECAS Governance Essential Work Area Group
    - Lee Jenni, G., M.N. Peterson, M. Foster, M., F. Cubbage, G. McMahaon. Development of a SECAS Conservation Decision Guidance Library: Open Pine Management: Decision Making Factors. SECAS Governance Essential Work Area group meeting. 11 September 2015.

- Conference Presentation at the Society of American Foresters Convention
    - Foster, M., F. Cubbage, J. McMahon, and M.N. Peterson. Understanding the Decision Context for Landscape Scale Conservation: the Case of Longleaf Pine Restoration in the Southeast. Society of American Foresters Convention. Salt Lake City, UT. 8-11 October 2014.

- Webinar Presentation for the SECAS Governance Essential Work Area Group
  - Foster, M., F. Cubbage, J. McMahon, and M.N. Peterson. Evaluating Natural Resource Management Plans: Insights for Longleaf Pine Restoration Planning. SECAS Governance Essential Work Area group meeting. 29 April 2015.

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Appendix 1. Decision Maker Questionnaire.

This questionnaire is designed to evaluate how the personas of decision makers influence their decision making. It is important to understand the variety of individual and societal characteristics that influence how people utilize information in decision making. Defining decision-making personas can help illustrate how these characteristics impact individual decision-making processes. This questionnaire has four components: process, social network, climate change perceptions, and demographics.

Part A. Process

Check one.

1. The current decision making process is…
   [ ] not effective
   [ ] somewhat effective
   [ ] mostly effective
   [ ] totally effective
   [ ] I don't know

2. Is sufficient information available to make decisions?
   [ ] Yes
   [ ] No
   [ ] I don't know

3. Management decisions are made on the following scales: (check all that apply)
   [ ]long term
   [ ]short term
   [ ]I don't know

   [ ]local
   [ ]regional
   [ ]national
   [ ] I don't know

4. To what extent is collaboration a necessary part of decision making?
   [ ] not necessary
   [ ] somewhat necessary
   [ ]mostly necessary
   [ ]totally necessary
   [ ] I don't know

5. How influential are stakeholders in the decision making process?
   [ ] very influential
   [ ]somewhat influential
   [ ] not influential

6. Are alternatives thoroughly explored in the decision making process?
   [ ] Yes
   [ ] No
   [ ] I don't know

7. To what extent do these scientific barriers affect decision making? Check one for each barrier.

	Never	Rarely	Occasionally	Frequently	A Great Deal
Temporal mismatch					
Spatial mismatch					
Uncertainty					
Value of scientific information					
Missing information					
Other					

8. To what extent do these institutional barriers affect decision making? Check one for each barrier.

	Never	Rarely	Occasionally	Frequently	A Great Deal
Fiscal					
Political					
Historical					
Regulatory requirements					
Time sensitivity					
Other					

Check one.
9. Collaboration happens
   [ ] not at all
   [ ] somewhat frequently
   [ ] frequently
   [ ] very frequently
   [ ] all the time

10. To what extent do you feel the following are challenges to working with collaborators or inhibit your use of collaborators? Check one for each challenge.

	Never	Rarely	Occasionally	Frequently	A Great Deal
Fiscal					
Political					
Historical					
Regulatory requirements					
Time sensitivity					
Other					

Check one.
11. Do you currently work with partners?
   [ ]Yes
   [ ] No

12. Is working with partners listed in your position description?
   [ ]Yes
   [ ] No

13. We are interested in knowing why you don't work with partners (check all that apply).
   [ ]There are few partners available to work with
   [ ] My work assignment is not conducive to working with partners
   [ ]Working with partners is not part of my job description
   [ ] I do not have the flexibility to work with partners
   [ ] Partnerships are not strongly encouraged in our agency
   [ ] It is not something that I considered before
   [ ] I am not interested in working with partners
   [ ] I don't believe in outsourcing government work
   [ ] Other (please specify)

14. To what extent do you typically work with the following types of partner groups? Check one for each partner group.

	Never	Rarely	Occasionally	Frequently	A Great Deal
Groups or individuals who show up one time for a particular event of project					
Groups or individuals who show up periodically as needs arise					
Groups or individuals involved in annual or periodic events					
Groups or individuals involved in a long-term collaborative process					
Groups or individuals that provide an ongoing assistance					
Other					

Part B. Social Network

1. List the people/organizations you think are important to your position (<u>in terms of support you received in decision making</u>).

Name of person/business/ organization	Type of support provided (check all that apply)	Relationship to you [ ] Colleague within agency [ ] Colleague outside of agency [ ] Other (check all that apply)	Length of connection (years or months)	Mode of communication (check all that apply)	Frequency of communication	Importance of these ties in management success
	[ ] Financial [ ] Decision-making [ ] Collaboration [ ] Planning [ ] Information sharing [ ] Emotional [ ] Other: _____	[ ] Colleague within agency [ ] Colleague outside of agency [ ] Other		[ ] Email [ ] Phone [ ] In person [ ] Other:_____	[ ] Daily [ ] Weekly [ ] Monthly [ ] Quarterly [ ] Annually	[ ] Not at all important [ ] Slightly important [ ] Moderately important [ ] Very important [ ] Extremely important
	[ ] Financial [ ] Decision-making [ ] Collaboration [ ] Planning [ ] Information sharing [ ] Emotional [ ] Other: _____	[ ] Colleague within agency [ ] Colleague outside of agency [ ] Other		[ ] Email [ ] Phone [ ] In person [ ] Other:_____	[ ] Daily [ ] Weekly [ ] Monthly [ ] Quarterly [ ] Annually	[ ] Not at all important [ ] Slightly important [ ] Moderately important [ ] Very important [ ] Extremely important
	[ ] Financial [ ] Decision-making [ ] Collaboration	[ ] Colleague within agency [ ] Colleague outside of agency		[ ] Email [ ] Phone [ ] In person	[ ] Daily [ ] Weekly [ ] Monthly	[ ] Not at all important [ ] Slightly important [ ] Moderately important

	[ ] Planning	[ ] Other		[ ] Other:_____	[ ] Quarterly	[ ] Very important
	[ ] Information sharing	)			[ ] Annually	[ ] Extremely important
	[ ] Emotional					
	[ ] Other: _____					

Check one.

2. Did you consult the five individuals with whom you feel you have the most important information sharing relationship with when developing the most recent plan?

[ ] yes

[ ] no

3. Did you consult the five individuals with whom you feel you have the most decision-making relationship with when developing the most recent plan?

[ ] yes

[ ] no

4. On a scale of 1-5, please circle your level of agreement with each of the following statements (1 indicates strongly disagree and 5 indicates strongly agree).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Most people in my network are honest	1	2	3	4	5
I think people in my network can be trusted	1	2	3	4	5
I feel like people in my network trust me	1	2	3	4	5
People in my network are not solely interested in their own welfare	1	2	3	4	5
If I have a problem, there is always someone in my network to help me	1	2	3	4	5
I am willing to offer help to people in my network, if needed	1	2	3	4	5
I have a good rapport with people in my network	1	2	3	4	5
I think people get along very well in my network	1	2	3	4	5
People in my network socialize with each other very often	1	2	3	4	5
I feel like there is a great social bonding among members of my network	1	2	3	4	5

C. Climate Change Perceptions

15 Item Instrument

Recently you may have noticed that global warming has been getting some attention in the news. Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result. Check one.

1. What do you think? Do you think that global warming is happening?

    Yes...
     [ ] …and I'm extremely sure
     [ ] …and I'm very sure
     [ ] …and I'm somewhat sure
     [ ] …but I'm not at all sure

    No...
     [ ]...and I'm extremely sure
     [ ]...and I'm very sure
     [ ]...and I'm somewhat sure
     [ ]...but I'm not at all sure

    Or...
     [ ] I don't know

2. Assuming global warming is happening, do you think it is ...
    [ ] Caused mostly by human activities
    [ ] Caused mostly by natural changes in the environment
    [ ] Other
    [ ] None of the above because global warming isn't happening

3. How worried are you about global warming?
    [ ] Very worried
    [ ] Somewhat worried
    [ ] Not very worried
    [ ] Not at all worried

4. How much do you think global warming will harm you personally?
    [ ] Not at all
    [ ] Only a little
    [ ] A moderate amount
    [ ] A great deal
    [ ] Don't know

5. When do you think global warming will start to harm people in the United States?
   [ ] They are being harmed now
   [ ] In 10 years
   [ ] In 25 years
   [ ] In 50 years
   [ ] In 100 years
   [ ] Never

6. How much do you think global warming will harm future generations of people?
   [ ] Not at all
   [ ] Only a little
   [ ] A moderate amount
   [ ] A great deal
   [ ] Don't know

7. How much had you thought about global warming before today?
   [ ] A lot
   [ ] Some
   [ ] A little
   [ ] Not at all

8. How important is the issue of global warming to you personally?
   [ ] Not at all important
   [ ] Not too important
   [ ] Somewhat important
   [ ] Very important
   [ ] Extremely important

9. How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."
   [ ] Strongly agree
   [ ] Somewhat agree
   [ ] Somewhat disagree
   [ ] Strongly disagree

10. How many of your friends share your views on global warming?
   [ ] None
   [ ] A few
   [ ] Some
   [ ] Most
   [ ] All

11. Which of the following statements comes closest to your view?
    [ ] Global warming isn't happening.
    [ ] Humans can't reduce global warming, even if it is happening.
    [ ] Humans could reduce global warming, but people aren't willing to change their behavior so we're not going to.
    [ ] Humans could reduce global warming, but it's unclear at this point whether we will do what's needed.
    [ ] Humans can reduce global warming, and we are going to do so successfully.

12. Do you think citizens themselves should be doing more or less to address global warming?
    [ ] Much less
    [ ] Less
    [ ] Currently doing the right amount
    [ ] More
    [ ] Much more

13. Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?
    [ ] Never
    [ ] Once
    [ ] A few times (2-3)
    [ ] Several times (4-5)
    [ ] Many times (6+)
    [ ] Don't know

14. Do you think global warming should be a low, medium, high, or very high priority for the President and Congress?
    [ ] Low
    [ ] Medium
    [ ] High
    [ ] Very high

15. People disagree whether the United States should reduce greenhouse gas emissions on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view?

    The United States should reduce its greenhouse gas emissions ...
    [ ] Regardless of what other countries do
    [ ] Only if other industrialized countries (such as England, Germany and Japan) reduce their emissions
    [ ] Only if other industrialized countries and developing countries (such as China, India and Brazil) reduce their emissions
    [ ] The US should not reduce its emissions
    [ ] Don't know

D. Demographic Questions:

1. Gender:

   [ ] Male

   [ ] Female

2. In what year you were born? _____

3. What is your education level? Check one.

   [ ] High school graduate

   [ ] Bachelor's degree

   [ ] Some college, no degree

   [ ] Graduate or professional degree

   [ ] Associate's degree

4. What is your official position title? _____

5. How many years have you served in this position? _____

6. How many years have you worked for the agency you currently work for? _____

7. Can you please give me the names and contacts of at least 3 other individuals involved in a similar type natural resource management?
   _____

Appendix 2. Plan Evaluation Tool

Name of Organization _____

Name of Plan _____

Unique ID# _____

<div style="border:1px solid">

Coding Categories:

2= Identified, detailed, relevant

1=Identified, vague, incomplete

0=Not identified

</div>

Internal Plan Qualities:

1. ISSUES AND OBJECTIVES STATEMENT

		SCORE	PAGE #
1.01	Is the primary driver requiring this plan explained?	0 1 2	
1.02	Is the decision maker/administrative authority for the planning effort indicated?	0 1 2	
1.03	Is there a preliminary assessment of major trends related to the open pine ecosystem?	0 1 2	
1.04	Is there a description of major threats to the open pine ecosystems?	0 1 2	
1.05	Is there an overall objective of what the plan is working towards?	0 1 2	
1.05.1	Are objectives clearly stated?	0 1 2	
1.05.2	Are objectives measurable?	0 1 2	
1.05.3	Are objectives prioritized?	0 2	
1.05.4	Are fundamental objectives considered?	0 1 2	
1.05.5	Are means objectives considered?	0 1 2	
1.06	Are alternatives considered?	0 1 2	
1.06.1	How many alternatives are considered?	_____	
1.07	Is there a process for changing objectives based on changing conditions?	0 1 2	
1.08	Is there a review of the challenges managers must overcome to achieve the objectives?	0 1 2	
1.09	Is there a description of assets available to managers relating to open pine ecosystem management?	0 1 2	

SCORE:_____ /28

2. FACT BASE

		SCORE			PAGE #
2.01	Contains analysis of current and future conditions impacting the open pine ecosystem.	0	1	2	
2.02	Gives an assessment of the current state of the landscape.	0	1	2	
2.03	Are clear maps included which display information that support reasoning and enhance relevance and comprehensibility?	0		2	
2.04	Are tables clear, relevant, and comprehensible?	0		2	
2.05	Is language used clear and understandable to reader?	0		2	
2.06	Are data sources cited?	0		2	
2.06.1	Are data sources peer-reviewed?	0		2	

SCORE: _____ /14

3. PLAN PROPOSALS AND IMPLEMENTATION

		SCORE			PAGE #
3.01	Are actions for implementing plans clearly identified?	0	1	2	
3.02	Are actions for implementing plans prioritized?	0		2	
3.03	Are timelines for implementation identified?	0	1	2	
3.04	Are specific individuals within the organization assigned responsibilities for implementation?	0		2	
3.05	Is funding allocation identified to implement the plan?	0	1	2	
3.06	Is evaluation criteria identified?	0	1	2	
3.06.1	Is evaluation criteria tied to objectives?	0	1	2	
3.07	Is there a timeline for updating the plan?	0	1	2	
3.08	Is there a process for updating the plan based on changing conditions or the result of new monitoring data?	0	1	2	

SCORE: _____ /18

External Plan Qualities:

4. INTERDEPENDENCY AND INTEGRATION WITH OTHER PLANS

		SCORE	PAGE #
4.01	Are horizontal connections with other plans or organizations explained?	0 1 2	
4.02	Are vertical connections with national, regional, and local plans and organizations explained?	0 1 2	

SCORE:_____/4

5. STAKEHOLDER PARTICIPATION

		SCORE	PAGE #
5.01	Are organizations and individuals involved in the plan preparation and implementation identified?	0 1 2	
5.02	Is there an explanation of why the organizations and individuals were involved in the plan preparation or implementation?	0 1 2	
5.03	Does the plan incorporate input from non-agency stakeholders?	0 2	
5.04	Are the stakeholders involved representative of those groups that will likely be impacted by the plan?	0 1 2	
5.05	Is there an explanation of participation techniques that were used?	0 1 2	

SCORE: _____/10

TOTAL SCORE: _____/74

(0-14) VERY POOR

(14-28) POOR

(29-44) FAIR

(45-59) GOOD

(60-74) EXCELLENT

Appendix 3. Interview protocol

Development of a SECAS Conservation Decision Guidance Library

Time & Date:

Place

Interviewee:

Introductory Protocol

Thanks for taking the time to sit down with us. We asked you to speak with us today because you have been identified as someone who is knowledgeable about the decision making process of managing open pine ecosystems. Our research project is focused on understanding decision-making, with particular interest in exploring any possible barriers to making "good" decisions and how we might move past those barriers. Our study is not an evaluation of current decision-making practices. Rather, we are trying to learn more about what we can do, if anything, to assist you.

To facilitate our note taking, and to make sure we quote you correctly, we would like to record our conversations today. Please sign the release form. For your information, only researchers on the project will be privy to the tapes, which will be eventually destroyed after they are transcribed. Also, please sign this form devised to meet our human subject requirements. Essentially, this document states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable, and (3) we do not intend to inflict any harm. Thank you for your agreeing to participate.

We have several questions that we would like to cover.

1. Why do open pine ecosystems matter? (Why are they important?)
2. What are some of the challenges these systems are facing?
3. Briefly describe your organization and its relationship with open pine ecosystems.
4. What are your objectives associated with open pine ecosystems? (probe: What are you working towards?
5. How are management objectives determined? Are objectives dynamic? Is climate change a consideration for changing management plan objectives?
6. What actions were considered to achieve above objectives? (Why? What? How many?) What were some of the factors that were involved in deciding what actions are needed to achieve those objectives?
7. Who are the decision makers?

8. Did you need to involve stakeholders? Which kinds? Why?
9. What types of information do you need to make good decisions? Do you have this information? What information do you wish you had? Is it available? Where?
10. What is the decision timing and frequency? (Are other decisions linked to this one? What factors do you consider during the decision making process?)
11. Do you have a written management plan for open pine systems?
    a. If yes –
        i. How do the document/s link to your objectives setting and stakeholder interactions? Can we obtain a copy of the plans?
        ii. How are these plans developed? What information do you use to develop these plans?
        iii. Are there any barriers to effective plan development and implementation? What? Are there any challenges for managers to overcome to achieve objectives? What?
    b. If no –
        i. End interview
        ii.
12. Thanks for your time; do you have any other suggestions for people that I should speak to?

Other Topics Discussed:

Documents Obtained:

Post Interview Comments or Leads: