Information and Decision-support tools

1. Introduction

The Board directed the department to provide information to assist their decision on defining one or more monitoring questions focused on streamside protections in Eastern Oregon and Siskiyou. The Board also requested proposed methods and timelines to answer the questions. The department is completing various analyses that provide this information (Table 1).

Table 1. Summary of information and analyses for the Board

Title	Information type	Status
Survey	Public opinion	Data collected & analyzed
Written comments	Public opinion	Data collected & analyzed
GIS	Landscape	Data collected and analyzed
Voluntary Measures	Land management	Data collected and analyzed
Harvest type	Land management	Data collected and analyzed
Compilation of Existing Science	Science	Some data collected, not yet analyzed
Study Method	Conceptual review approaches	Outlined in this document

Information in bold are described in more detail in the Section 2 of this document. All of the remaining analyses were presented in July 2017[1], except the compilation of existing science. This compilation is ongoing, and will be presented to the Board when they next address this topic (tentatively set for March 2018).

This information is organized in a decision matrix to help the Board make their choices (Section 3.B).

2. Analyses and information

2.A Survey

Methods

The department reached out to potentially interested or affected parties to encourage input on the selection of monitoring questions. We found these parties through a variety of means, e.g., talking with Tribes, stakeholder groups, Oregon Department of Forestry (ODF; "the department") field staff, and searching online. To help the parties better understand this effort to define monitoring questions and how they may participate, we shared background information on this process through a variety of contact methods, including meetings, webinars, emails, and phone calls. We made over 50 contacts with potentially interested parties.

We designed a survey intended to work with stakeholders and interested parties about priorities for monitoring, in the form of science reviews or field data collection projects, relating to streamside protections in the Siskiyou and eastern Oregon geographic regions (see Attachment 3

[1] BOFATTCH_20170725_07_01

for the survey and associated introductory letter). Survey questions stayed within the scope of current Forest Practices Act (FPA) riparian rules and focused input on the goals and purpose of the riparian rules. Rule language was rephrased in survey questions to make it accessible to a broad audience. Questions were directly linked to the goals and purposes of rules, or groups of rules, or to understand perceptions around acceptable forms of data to use in science reviews (Appendix 1). The survey was designed to:

- Describe <u>who</u> responded (questions 1-3); this included self-selection of a group[2] to which respondents believed they belong, in which geographic region(s) they or their group resided.
- Elucidate what, why, where, and how respondents thought ODF should direct monitoring efforts:
  - <u>What to focus on</u>(questions 5, 8, and 9): Water protection purpose, goals and desired future conditions for streamside vegetation
    - Goals (fish habitat, wildlife habitat, and water quality)
    - Desired Future Condition (vegetation retention measures for streams)
  - <u>Why to focus on these aspects:</u> (questions 6 and 7) Achievement and maintenance of specific water quality standards, conifer retention, active streamside management actions, various aquatic and wildlife habitat components and functions, etc.
  - <u>Where:</u>
    - To which geographic region(s) their responses applied (question 4)
    - On what stream types to focus (questions 10 and 11)
    - On what stream sizes to focus (questions 12 and 13)
  - <u>How:</u> What type of information should ODF use to assess the state of information relative to key issues identified through the survey; this includes e.g., peer-reviewed publications, watershed council data, government white papers (questions 14 and 15)

There was a final, open-ended question soliciting additional thoughts on the monitoring question selection process (question 16).

Many of the survey questions were multiple choice. Additionally, some questions allowed for narrative responses. These questions included three multiple choice questions that had "Other" as a choice, with the option to fill in a narrative description. In addition, there were six questions for which narrative responses were the only option when respondents chose to answer it. To assess these narrative responses, staff coded responses into categories, and had a second staff member assess a sub-set of categorization for consistency and "reasonableness". While this process is subjective, it is an accepted method to analyze qualitative data.

Potential survey respondents were emailed a link to the online survey, and had almost 6 weeks to complete it. To encourage as much participation as possible, and conduct an open process, we

[2] Note: At the July 2017 Board of Forestry meeting, Attachment 1 incorrectly stated that ODF placed survey participants in groups. The survey was actually designed to have participants make their own selection as to what group (or perspective) they represented (see Attachment 2 for survey groups).

did not place any restrictions on who may participate: anyone who received the email (including if it was forwarded from someone outside the department) could take the survey. It is therefore important to note that data from the survey are intended to illustrate a range of perspectives, and not what responses received the most votes. Additionally, this effort was not a random sample, and does not guarantee sufficient representation or samples for the different groups for statistical rigor.

Results

Who responded and where do they reside (Questions 1-3)

Eighty-four (84) people participated in the survey from a wide range of perspectives (Table 2). Note that some parties chose to provide written comment and did not complete the survey (see section 2.B), and not all participants answered every question. Three groups had more than ten respondents, and another five groups had 5-9 respondents. To help understand similarities and differences between respondent groups, questions are assessed with respect to these groups, with the caveat that group answers are not statistically valid – rather, they provide an understanding of the range of responses. Additional details for some questions are presented in Appendix 1.

Respondents live or represent diverse areas (Figure 1). Each of the groups with over 5 respondents were fairly evenly spread across these regions. Of the geographic regions where respondents live, Blue Mountains had the most (39), Eastern Cascades the fewest (22), and Siskiyou (33) and Other (28) were intermediate. Respondents were able to select more than one area.

Table 2. Number of survey participants from the various self-selected categories.

Category	# of participants
Academic	3
Board Committees	3
County	2
Federal agency	1
Industrial Landowner	17
Non-industrial Landowner	6
ODF Staff	5
Other	18
State agency	5
Tribes	6
Watershed Councils	7
Conservation	11

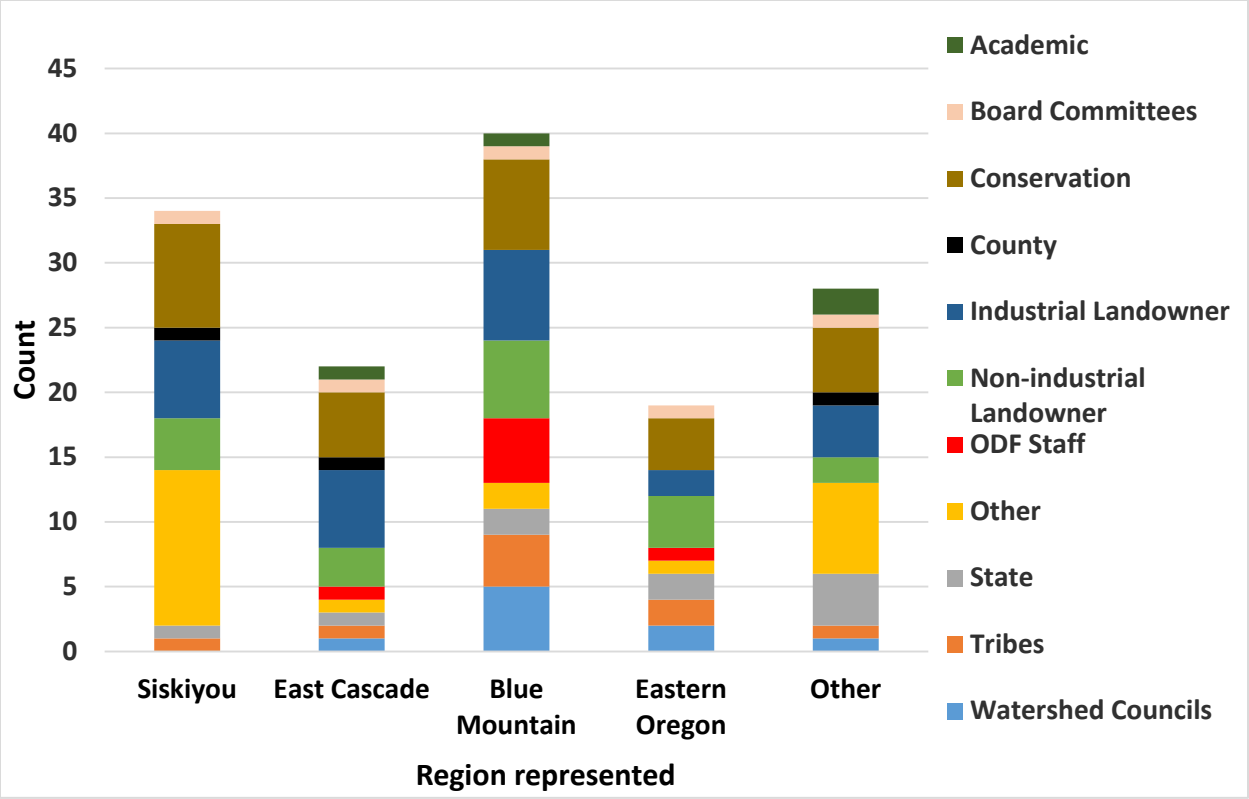

Figure 1. Regions in which survey respondents live. Note that totals are larger than the number of survey responses since some respondents represented groups with members in multiple locations (question 3).

Regions to which responses apply (question 4)

In terms of the geographic region(s) to which respondents' answers apply (Figure 2), Blue Mountains was selected by the most respondents (63), with eastern Cascade the least (48), and Siskiyou in between (53). All groups with at least five respondents had some people selecting each region, and most groups had moderately even selection across all the regions.

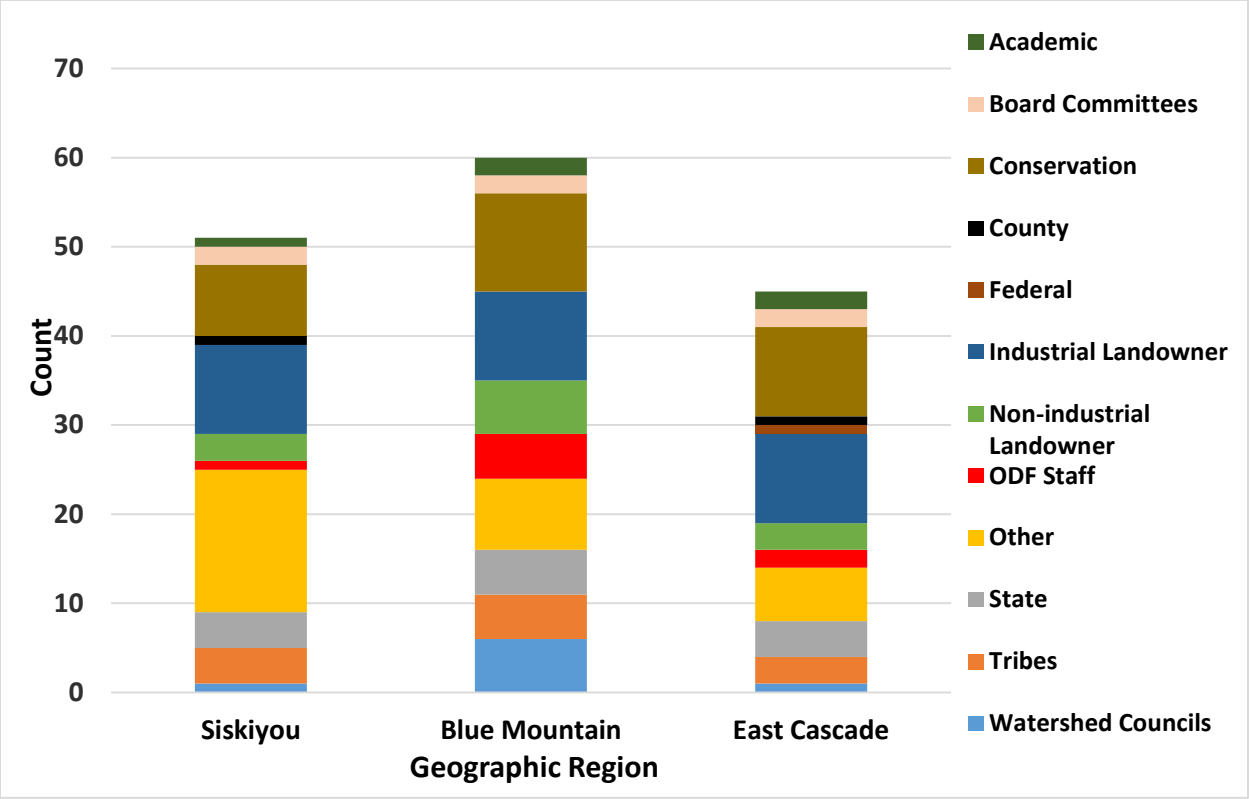

Figure 2. Geographic region(s) to which respondents' answers apply (question 4).

What monitoring issues are important and why (questions 5-9)

Question 5 was meant to elicit responses about the perceived importance of monitoring particular aspects of the goals and purpose of the riparian protection rules. Respondents could select multiple answers. Over 75% of respondents selected water quality, healthy streamside forests, and fish habitat, with 60% selecting wildlife habitat (Figure 3). About a quarter of respondents selected the "other" response option which allowed for text responses. Repeated themes in the "Other" responses included, but were not limited to, comments about the importance of stream buffers and buffer widths, fish biology and response, water quality generally, stream temperatures, sediment delivery, wood recruitment, overall stream and riparian function health, and wildlife habitat. Other comments focused on: factors outside the scope of the FPA (e.g., mining, non-forest protection measures), offered input about study approaches (e.g., focus on fish response rather than temperature), or indicated that this monitoring project should not be considered a priority action item (three respondents). All groups with at least five respondents had some people selecting each defined topic, and most groups had fairly even selection across all the topics.

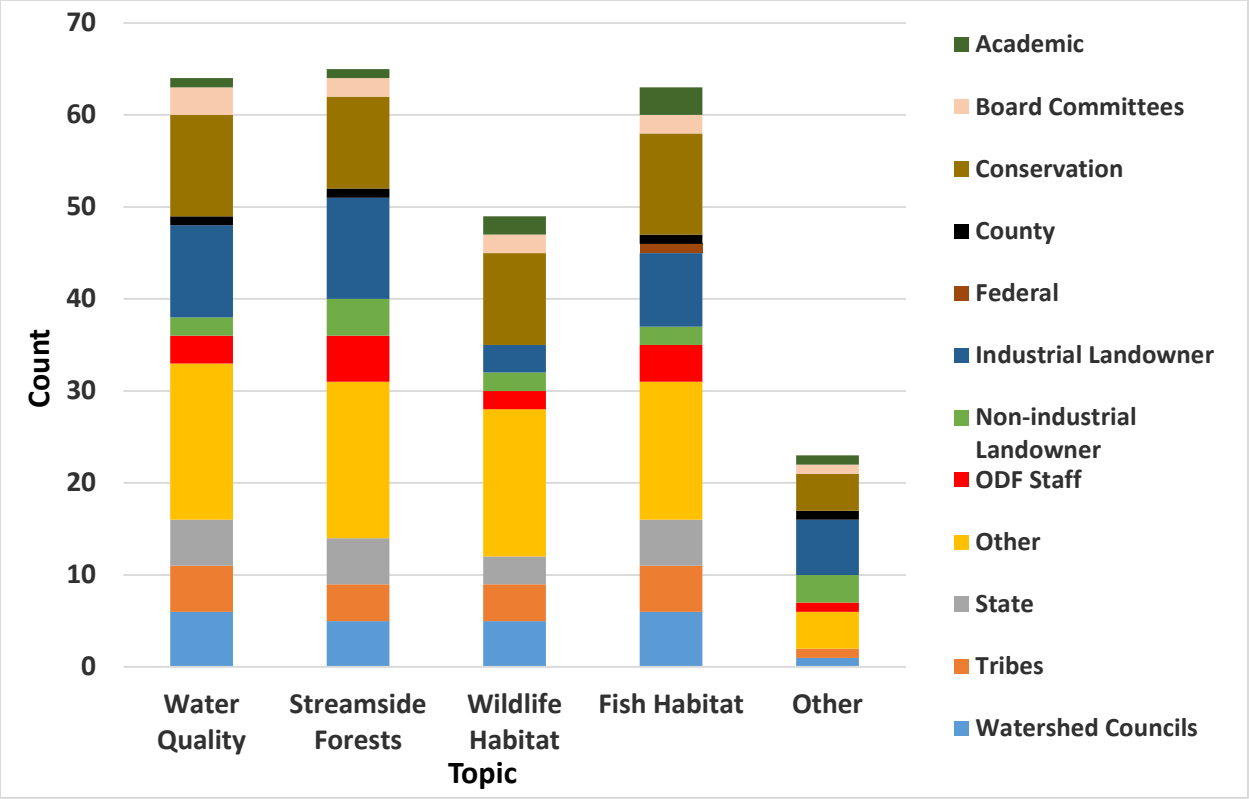

Figure 3. Streamside issues respondents thought ODF should monitor (question 5). One respondent skipped this question.

Question 7 allowed for additional comments on which streamside issues to review and monitor. Taking a holistic approach was addressed the most frequently (ten respondents), followed by objections to undertaking monitoring (four respondents), and a preference for focusing on fish biology and response (three respondents).

When asked to prioritize topics to review and monitor (question 8; Figure 4a), water quality was highest (25), followed by healthy streamside forests (23), fish habitat (14), "Other" (13), and wildlife habitat (5). For those that selected the Other category, three respondents objected to conducting a monitoring review, and two people expressed a preference for focusing on approaches including fish biology and response or holistic looks (broad scope). Looking at prioritization by groups with over 10 respondents:

- Industrial Landowners: Healthy streamside forests (6), other (4), fish habitat (3), water quality (3), wildlife habitat (1), and one person did not prioritize.
- Conservation: Water quality (7), fish habitat (3), and other (1)
- Other: water quality (7), fish habitat (5), healthy streamside forests (3), other (2), and wildlife habitat (1)

For the second priority (Figure 4b), fish habitat received the most votes (25), followed by water quality (20), healthy streamside forests (13), and wildlife habitat (8).

If the three groups with the highest number of respondents are filtered out (industrial landowners, conservation, and other), healthy streamside forests becomes the first priority issue

with the most votes, followed by water quality and other issues category. These remaining groups with fewer respondents did not display clear patterns of issue priorities, but instead tended to have individual votes for priority topics spread amongst several issues. Four of five ODF responses, however, prioritized healthy streamside forests. Leaving ODF responses out of the survey still put healthy streamside forests as the top issue for these smaller respondent groups.

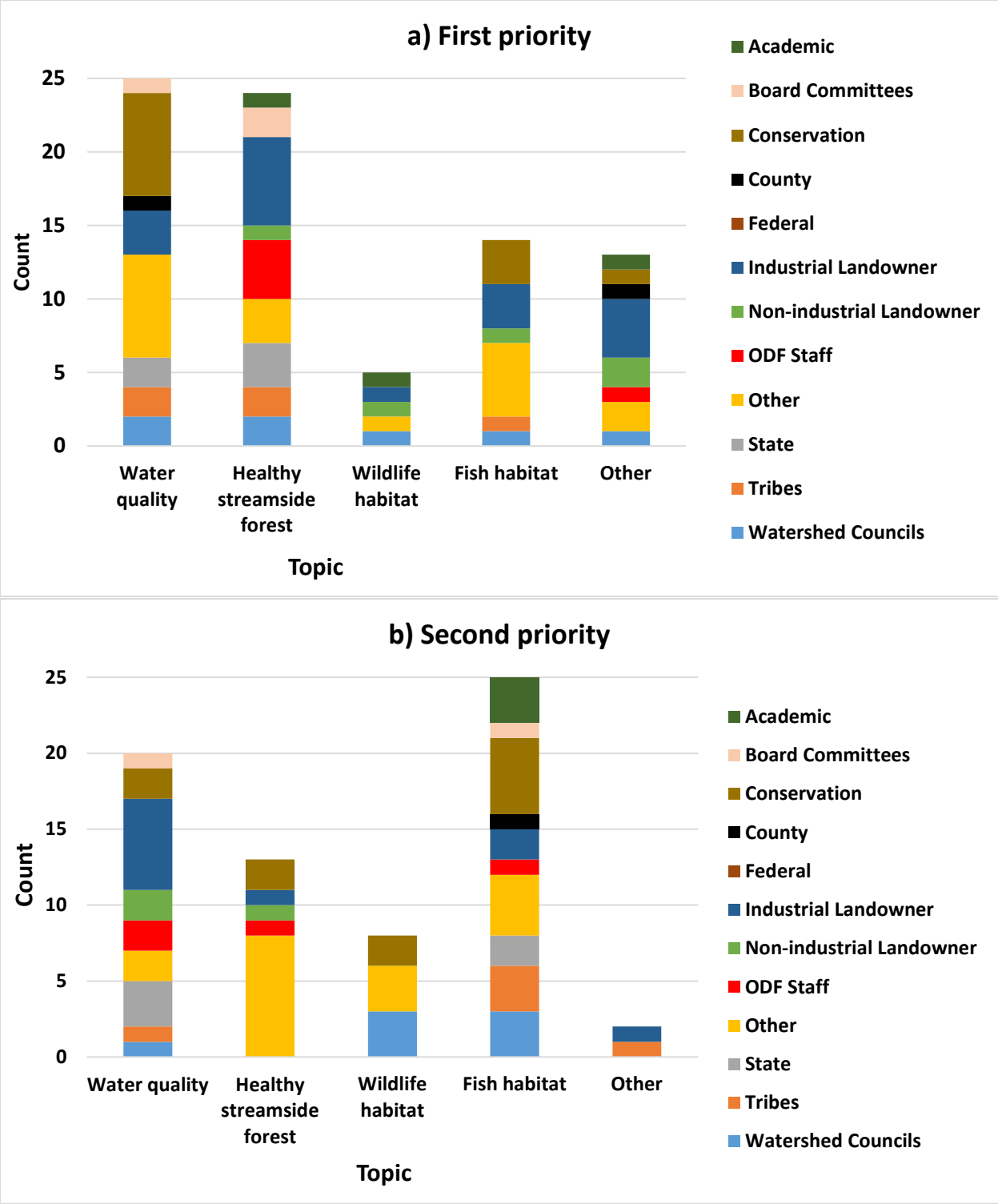

Figure 4. First (a) and second (b) priorities for review topic based on self-selected groups (question 8). Three survey respondents did not answer this question.

Based on the analysis above, it would appear that the priority issues identified by survey respondents was water quality and healthy streamside forests. Fish habitat and other issues were the next priorities. To further narrow down to potential monitoring questions (and corresponding FPA rules), respondents were then asked about why these issues were important (Figure 5). The top two reasons (>69%) why respondents were interested in monitoring streamside protection rules were due to stream temperature and shade. These were followed closely by large wood recruitment and active management of streamside forests (59% and 56%, respectively). Other water quality parameters, conifer retention, and the maintenance of various tree species and sizes were also important (43-49% of respondents).

Conservation and Other respondents appeared to see stream temperature, shade, and large wood as the top priority reasons for monitoring, whereas Industrial Landowners respondents most commonly prioritized active streamside management for forest health reasons, but could also see value in monitoring stream temperature and shade (Figure 5). Beyond this, it is difficult to attribute clear preferences to groups with smaller respondent sample sizes, as their responses are distributed throughout the other possible reasons why to monitor. With these largest groups filtered out, the top priority reasons for monitoring remain the same.

Where to monitor: Stream type (questions 10 and 11)

The majority of respondents (59) selected Type F (fish-bearing) streams as the top priority, and the majority of every group with at least 5 respondents selected this as well (Figure 6). Types N (non-fish bearing) and D (domestic use) were selected as top priority by few respondents (eight for each type). For the second priority, 44 respondents selected Type D, 18 Type N, and 12 Type F. Similarly, the total majority of respondents and majority of respondents by group selected Type D streams as the second priority. For narrative responses other than one of the three stream types, sixteen respondents indicated a preference to include all stream types. The remainder of responses covered a range of input such as: a desire for a data-driven process; the importance of small, headwater streams; "…studies done in conjunction with vested partners and not outside interests"; the importance of fish biology and response, and; limit the use of buffers to where they are most effective.

If the three groups with the highest number of respondents are filtered out (industrial landowners, conservation, and other) the overall results do not change, with Type F remaining the top priority stream type, followed by Type D streams.

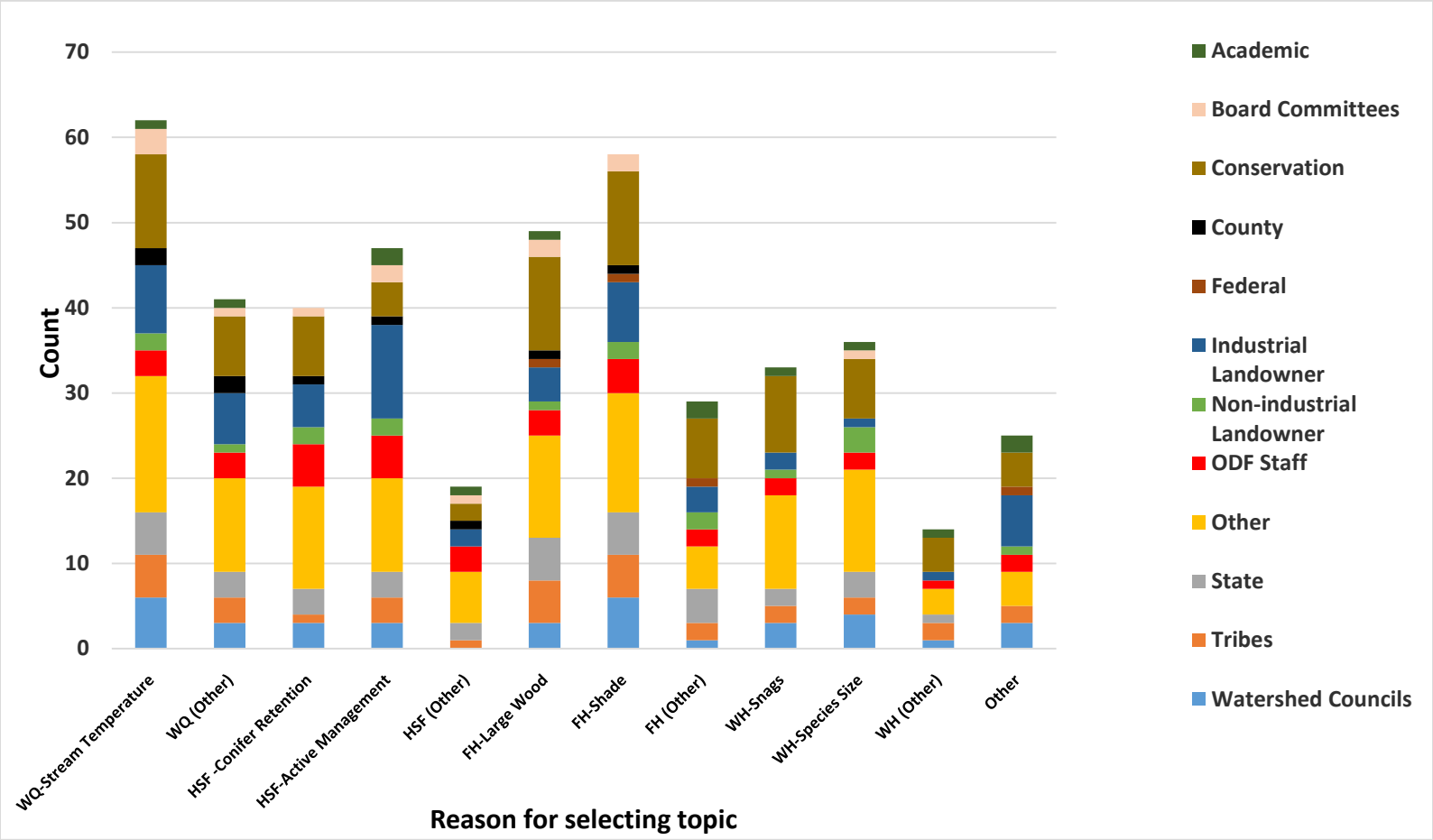

Figure 5. Reasons survey respondents selected various topics on which to focus the monitoring questions (question 6). One survey respondent did not answer this question. (WQ) water quality, (HSF) healthy streamside forest, (FH) fish habitat, (WH) wildlife habitat.

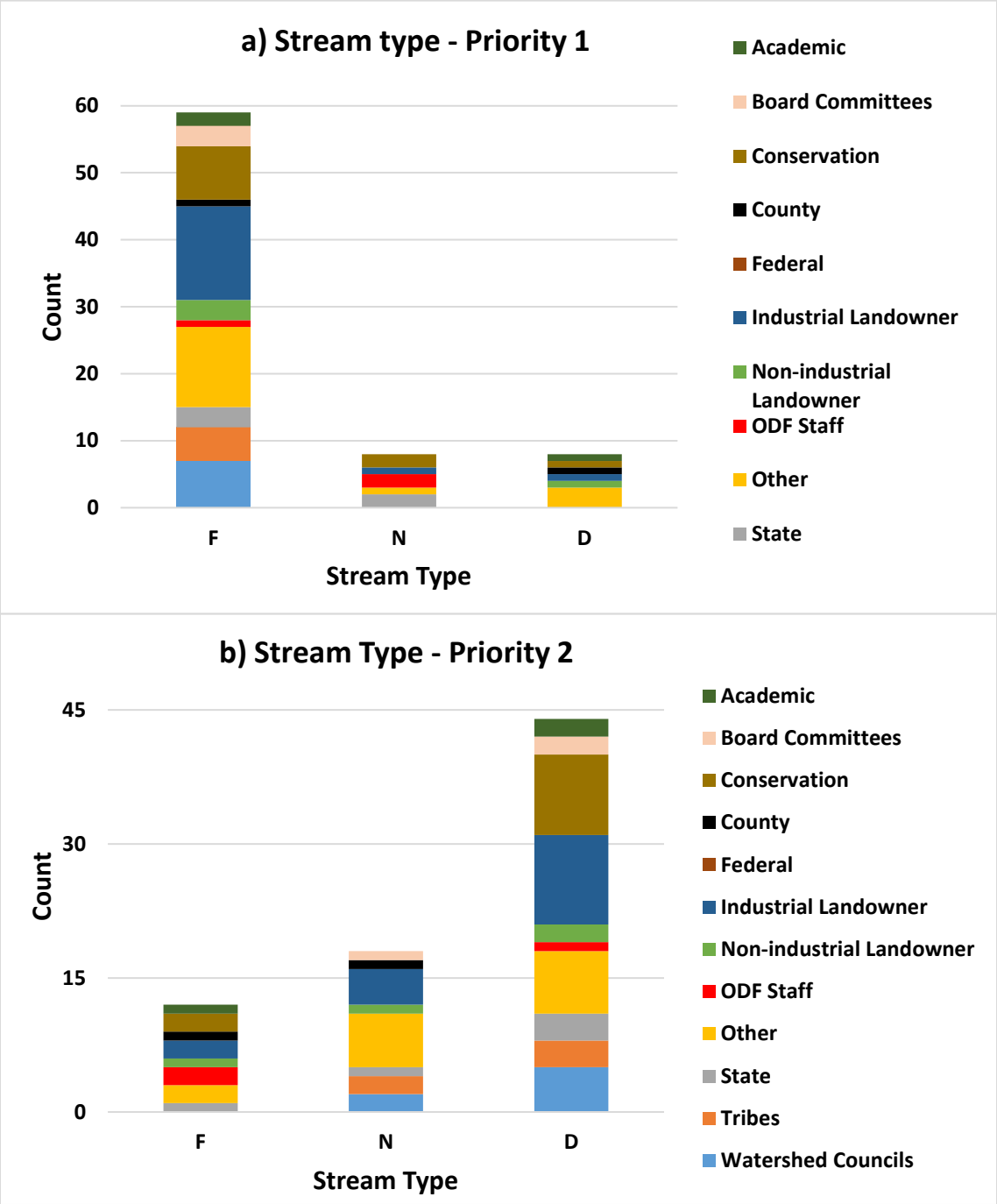

Figure 6. Prioritization of stream type by survey respondents (question 10), with each color representing responses from self-selected groups. a) First priority; b) second priority. Nine respondents did not answer this question. (F) Fish-bearing, (N) non-fish bearing, (D) domestic use.

Where to monitor: Stream Size (questions 12 and 13)

There was no strong priority exhibited for stream size[3]: medium (28), large (23), and small (26) (Figure 7). In terms of groups with at least 10 respondents, Industrial Landowners mostly chose large streams, Conservation and Other were each evenly split between medium and small (but few for large) streams. Medium streams were clearly selected as the second highest priority (48), followed by small streams (20), and large streams (9). Most respondents from Industrial Landowners and Other groups chose medium streams as their second priority, whereas Conservation was evenly split between medium and small streams. Most respondents who answered the narrative question suggested that either all stream sizes were important (9), or that the downstream effects were the most important consideration in their choices (11). These results did not change markedly if the Conservation, Other, and Industrial Landowner groups were filtered out.

[3] Small streams have an average annual flow of two cubic feet per second or less. Medium streams have an average annual flow greater than 2 and less than 10 cubic feet per second. Large streams have an average annual flow of 10 cubic feet per second or greater.

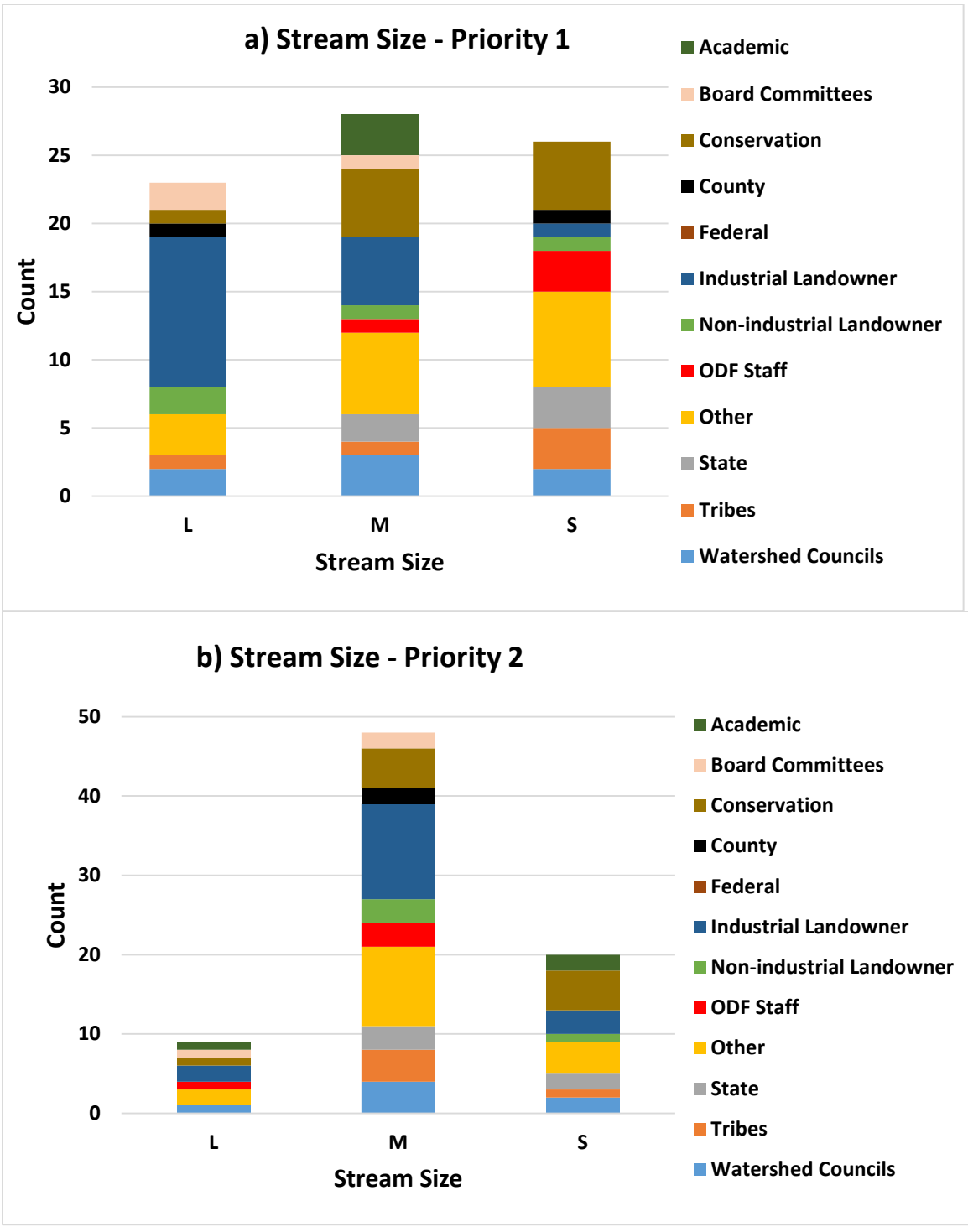

Figure 7. Prioritization of stream size by survey respondents (question 12), with each color representing responses from self-selected groups. a) First priority; b) second priority. Seven survey respondents did not answer this question. (L) Large streams, (M) medium streams, (S) small streams.

Additional thoughts (question 16)

When asked for additional thoughts on this process (question 16), 34 respondents provided answers. The most striking feature is that 13 of these people indicated they believed that the purpose of this monitoring question selection exercise is to change the rules, and typically stated strong opposition to, or strong support for, such changes. Another 11 respondents had diverse policy ideas to share, six shared scientific perspectives, and the remainder fell into various categories.

2.B Written comments

Methods

In the aforementioned outreach to potential survey respondents, we offered people the opportunity to submit written comments.

Results

We received input from eight entities, plus those of three Board advisory committees (Committee for Family Forestlands, and the Regional Forest Practice Committees from Southwest and Eastern Oregon; Attachment 2). While the written comments contain much information, we focus on information directly related to the suite of decisions the Board will make (see Section 3.A). Of those entities that submitted written comments, three did not fill out the survey (two forest landowner groups and one conservation-oriented group). The remaining entities and members of the Board advisory committees also completed the survey.

Perspectives on the priority topic to monitor fell primarily into two themes. Three conservation-oriented groups wanted to focus on water quality, primarily stream temperature. Five landowners plus the three Board advisory committees wanted to ensure fish biology was addressed in the monitoring effort, and were inclined to have a more comprehensive approach rather than focusing on a particular topic.

Regarding which geographic regions on which to focus efforts, there was a range of perspectives. The Siskiyou was selected as the primary focus by four groups (1 landowner, 2 conservation, and 1 Board committee), Eastern Oregon by one group (Board committee), all geographic regions by five groups (three landowners, one each of conservation and Board committee), and one landowner did not specify an area.

Regarding stream type and size on which to focus most groups did not specify any stream size on which to focus, except two conservation groups that both wanted to focus on small and medium Fish streams. All groups focused on Fish streams, except one conservation group that did not specify a stream type.

All groups suggested it was important to have a high degree of rigor to any science that informs subsequent Board decisions. However, they differed depending on their focus: Conservation groups thought that RipStream[4]-level rigor regarding stream temperature was warranted, and felt its results could even be extrapolated to at least the Siskiyou, triggering the need to modify

[4] RipStream; Riparian Function and Stream Temperature - Effectiveness of Oregon Department of Forestry's Protection Rules and Strategies Riparian Function and Stream Temperature Study Approach. Oregon Department of Forestry, 2003. Available upon request.

riparian rules. In contrast, landowner groups opted towards a paired-watershed approach, and some explicitly stated that RipStream results should not be extrapolated outside the area of the 2016 Salmon, Steelhead, and Bull Trout riparian rule.

2.C Assessment of requirements for various levels of study method

There are several levels of study method with which the department could address a monitoring question (Table 3). For the purposes of this discussion, we describe the attributes of the study approaches in a brief manner, recognizing there are numerous nuances we do not address at this stage. A conventional literature review consists of assessing information from studies, and writing a narrative about this assessment. A systematic review is a more rigorous literature review designed to minimize author bias, and lends itself well to including interested parties in the process. To complete both types of literature reviews in a manner that can robustly inform policy decisions, there needs to be an adequate number of relevant studies.

Alternately, a field study may be warranted. Such a study could span a wide range of study design, controls, data collection, and analysis. On one extreme, the Riparian Function and Stream Temperature project (RipStream) was started in 2002, and although data collection ended in 2010, analyses are ongoing as of winter 2017. To date, we have over 10 RipStream analyses either completed or underway, a number of which are published journal articles. On the other extreme are projects such as the leave tree pilot study (Weikel and Krahmer, 2006). It entailed approximately one season of field work at five harvest units, and yielded one technical report. A monitoring project of moderate complexity would roughly entail six months to a year to plan, 1-2 field seasons to complete, and six months to a year for analysis with an end product being a department technical report.

Table 3. Summary of study approaches, with estimated numbers for addressing a single topic.

Study approach	**Time to complete**[1]	**Number of FTE staff involved**	**Confidence and Applicability of results**
Literature review	6-9 months	0.5-0.75 FTE	Low to high[2]
Systematic review	12-15 months	0.75-1 FTE	Low to high[2]
Light field study	18-30 months	1-2 FTE, a few seasonals	Moderate
Intensive field study	60-180 months	1-4 FTE, plus numerous seasonals	High

[1] Timelines are in part affected by the level of interactions with interested parties

[2]Depends on whether there are a sufficient number of, highly-relevant studies; note that a literature review is also part of designing a field study.

3. Board Decisions

3.A Items for the Board to decide

The Board directed ODF to work with stakeholders to propose one or more questions and ODF began with disentangling various components of the questions about which the Board will ultimately decide. These decisions are broken down as follows:

1. What are the topics to address in the monitoring question and why?
2. Where should the monitoring questions focus? This question includes the following elements:
    a. Stream type(s) – Fish, Non-Fish, Domestic
    b. Stream size(s) – Small, Medium, Large
    c. Geographic regions – Siskiyou, Eastern Cascade, Blue Mountains
3. What methods and timelines will be used to answer the monitoring question?
    a. What type of information (e.g., peer-reviewed journal articles, status and trend data) should we use to assess the monitoring questions?

To help the Board understand what these decisions could look like, examples of previous decisions on this list was presented to the Board in July 2017[5].

3.B Proposed Decision Matrix, Range of Public Input, and Monitoring Questions

The department developed a proposed matrix to organize information from these analyses, and directly link it to the decisions the Board will make (Table 4). Staff have sought to encompass the range of input from survey and written responses. The "simple survey majority" is presented to indicate the outcome if staff had simply counted majority survey responses. Staff did not endeavor to provide every single facet of input received. This range is admittedly subjective but represents a good-faith effort of staff to share the range of public input. The Board may choose to incorporate other input as they see fit. Following Table 4 is a model question followed by a range of monitoring questions for the Board to consider.

[5] Information Analysis: Methods and Preliminary Results. Oregon Board of Forestry. July 25, 2017 Meeting. Agenda Item 7, Attachment 1. 8pp. http://www.oregon.gov/ODF/Board/Pages/BOFMeetings.aspx

Monitoring Question Element	**Survey Options/Written Responses**	**Range of Survey/Written Responses**	**Board Decision**	**Model Question** ***Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules…..***
Where (geographic regions)	Siskiyou; Blue Mountains; East Cascades; Other (written)	• Blue Mountains only (Simple survey majority) • Siskiyou and/or East Cascade (2nd survey priorities) • All geographic regions	Select one or more geographic regions	***….in the _____ geographic region(s)….***
Where (stream type)	Fish Non-fish Domestic	• Fish streams (1st survey priority) • Domestic streams (2nd survey priority) • Non-Fish streams (3rd survey priority, Written "Top Down" approach) • All Stream Types (Written, "holistic" approach)	Select one or more stream types	***…on _____ stream types…..***
Where (stream size)	Large Medium Small	• Medium (1st survey priority, simple survey majority) • Medium and/or Small (Top 2 priorities, written "Top Down" approach) • Large (3rd survey priority) • All stream sizes (Written, "holistic" approach)	Select one or more stream sizes	***….and _____ stream sizes….***
What (streamside protection rule purpose, goals)	Water Quality Fish Habitat Wildlife Habitat Healthy Streamside Forests	• Water quality (Simple survey priority) • Water Quality and/or Healthy Streamside Forests (Top 2 survey priorities) • Fish Habitat (2nd survey priority) • All purposes and goals (Written "holistic" approach)	Select what to focus on	***….to meet the _____ purpose or goals…..***
Why to focus on the streamside protection rule purpose, goals	Stream Temperature; Other Water Quality Topics; Conifer Retention; Active Streamside Forest Mgt; Other Healthy Forests Topics; Large Wood Recruitment; Shade; Other Fish Habitat Topics; Snags; Maint. Tree Spp. And Sizes; Other Wildlife Habitat Topics; Other Topics (generally)	• Stream Temperature (Simple survey majority) • Stream Temperature and/or Shade (Top 2 survey majorities) • Large wood recruitment and/or active streamside management (2nd survey priorities) • All (Written "holistic" approach)	Select why to focus on the above purpose or goals	***….relating to _____.***
Using what kind of data to inform the study	Published, peer-reviewed; Unpublished (gray/white); Status/trend fish data; TMDLs Riparian/aquatic habitat data; Voluntary measures data; Watershed Council data; Other data	• Peer-reviewed scientific articles (Simple survey majority) • Peer-reviewed scientific articles; status and trend data on fish populations; streamside and fish habitat data; voluntary measures on non-federal lands (Top survey majorities) • White/gray papers; Total Maximum Daily Load (TMDL) analyses; watershed council analyses (Second survey majorities) • Additional written responses: Soil and Water Conservation District data, Tribal data, federal agency data	Select the data types to be used as a foundation for a monitoring study	***Utilize research and monitoring data from _____ to inform the monitoring study.***
Other Decision Elements, Considerations	Open text responses (survey, written input)	• Conduct a study (field or literature review) that takes a holistic approach, considering beneficial uses and functions across entire watersheds and stream networks • Exercise caution in extrapolating research, data between geographic regions • Prioritize measurable, water quality objectives over unspecified fish habitat/fish response objectives • Prioritize inclusion of fish response and an overall holistic approach across stream types, sizes, and riparian, aquatic functions, over narrow topics and parameters such as water quality and stream temperature • Study designs should consider ownership types, ecological, vegetative site productivity, hydrologic, geologic, other land use, land use history variability, rigor in establishing control comparisons • Expedite completion of literature review, collection of field data • Do not expedite completion of literature review, collection of field data • Expedite increasing streamside protection standards in Siskiyou, Eastern Oregon • No need to expedite the increase or review stream protection standards in Siskiyou, Eastern Oregon	Select additional decision elements, considerations	***[Make alternate decision, modify monitoring question, or otherwise provide direction to the Department]***

Table 4. Proposed decision matrix linking monitoring question elements to a range of public input or responses, a Board decision, and finally the construction of a monitoring question, scientific data sources, and other guiding elements, considerations, or direction.

Below is a proposed range of monitoring questions for the Board to consider, including a no action alternative, based on the model question posed in Table 4 and summarized in the model question. This is followed by other Factors for Consideration, for the Board to use if they choose to modify or provide additional context and direction with their decision. Staff have sought to encompass the range of input from survey and written responses. The "simple survey majority" is presented to indicate the outcome if staff had simply counted majority survey responses. We did not endeavor to provide every single facet of input received. This range is admittedly subjective but represents a good-faith effort of staff to share the range of public input.

Model Question: Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rule in the _____ geographic region(s) on _____ stream types and _____ stream sizes to meet the _____ purpose or goals relating to _____. Utilize research and monitoring data from _____ to inform the monitoring study.

1) **No Action Alternative:** Do not conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules in the eastern Oregon and Siskiyou geographic region(s). Rely on adopted monitoring strategy for prioritizing department monitoring actions.
2) **Simple Survey Majority:** Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules in the Blue Mountain geographic region(s) on Type F (fish bearing) stream types and size medium streams to meet the water protection goal relating to stream temperature. Utilize research and monitoring data from peer reviewed research to inform the monitoring study.
3) **Overall Survey Majority:** Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules in the Siskiyou, East Cascade, and Blue Mountain geographic region(s) on Type F (fish bearing) stream types and size medium and small streams to meet the purpose and goal for healthy streamside forests and water protection relating to stream temperature, shade, large wood recruitment, and active streamside management. Utilize research and monitoring data from peer-reviewed scientific articles, status and trend data on fish populations, streamside and fish habitat data, and voluntary measures on non-federal lands to inform the monitoring study.
4) **Domestic Water Protection Focus:** Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules in the Siskiyou, East Cascade, and Blue Mountain geographic region(s) on Type D (domestic) stream types and all stream sizes (small, medium, large) to meet the water protection goal relating to state water quality standards. Utilize research and monitoring data from peer reviewed research to inform the monitoring study.
5) **Holistic Approach:** Conduct a study to assess the effectiveness of Forest Practice Act streamside protection rules in the Siskiyou, East Cascade, and Blue Mountain geographic region(s) on Type F (fish) and Type N (non-fish) stream types and all stream sizes (small, medium, large) to meet the purpose and goal relating to water protection and healthy streamside forests relating to stream temperature, shade, large wood recruitment, and

active streamside management. The response of beneficial uses (e.g. fish) should also be considered. Utilize research and monitoring data from peer-reviewed scientific articles, status and trend data on fish populations, streamside and fish habitat data, and voluntary measures on non-federal lands to inform the monitoring study.

6) **Siskiyou only.** Conduct a study to assess the effectiveness of FPA streamside protection rules in the Siskiyou on Type F streams and small and medium stream sizes to meet the water quality standards relating to stream temperature. Utilize research and monitoring data from peer reviewed research to inform the monitoring study.
7) **Other Factors for Consideration:**
    - Study extrapolation: Acceptable level of extrapolation of existing, new data collection between and beyond ODF geographic regions.
    - Study timeline: Priority within existing plan of work (fiscal year operating plan)
    - Study control, confounding factors: Expectations for control of background variability, other land uses, etc.
    - Study action (literature review or field study)

The suite of information from stakeholders in Table 4 provides a basis for constructing the questions above. For selecting a particular question, there is additional information the Board may consider. This information, developed via departmental analyses, includes:

- Harvest notifications: the number of miles of a particular stream type along recent forest harvests, and the number of notifications within 100 feet of Fish streams that are clearcuts and thins. Also displayed are stream miles that have anadromous fish habitat distribution. While not an FPA stream type classification, this information is useful to consider the magnitude of any potential linkage with monitoring questions focused on assessing effectiveness of rules in meeting state water quality standards for temperature, namely the Department of Environmental Quality Protecting Cold Water criterion.
- Totals: forested acreage owned by each owner category (e.g., industrial landowner), and the number of stream miles (by size and type) for these categories
- The number of voluntary measures implemented in support of the Oregon Plan for Salmon and Watersheds

This information, extracted specific to each question, is displayed in Table 5.

Table 5. Linking monitoring questions with GIS and other information. (NOAPs) Notification of Operation and/or Application for a Permit to use Fire or Power-Drive Machinery – data from 2015 and 2016; Oregon Plan for Salmon and Watersheds Voluntary Measures – data from 1995 through 2014. FPA stream Types and sizes - (S) small, (M) medium, (L) large streams; (F) fish, (N) non-fish, (D) domestic streams; Anadromous – Stream miles with anadromous fish distribution; Industrial, non-industrial, State land ownership.

Question Theme	Geographic Region (ac)	Acres in Geographic Region(s) (% **Industrial**/Non-Industrial/*State*)	Voluntary Measures (# reported)	FPA Stream Type(s)/ Stream Size(s), Anadromous	Total Stream Miles (% **Industrial**/Non-Industrial/*State*)	# Harvest NOAPs intersecting applicable stream types and sizes	% of NOAPs that are clearcuts (of clearcuts: % **Industrial**/Non-Industrial/*State*)
No action	NA	NA	NA	NA	NA	NA	NA
Simple Majority	Blue Mountain	1,499,844 (**39**/59/*1*)	237	F/M Anadromous	346 (**27**/71/*2*) 246 (**32**/66/*2*)	64	36 (**97**/3/*0*)
Majority	Blue Mountain East Cascade Siskiyou	3,991,282 (**49**/49/*2*)	782	F/M, S Anadromous	4,087 (**44**/54/*2*) 992 (**32**/67/2)	276	28 (**92**/7/*1*)
Domestic	Blue Mountain East Cascade Siskiyou	3,991,282 (**49**/49/*2*)	782	D/L, M, S Anadromous	5 (**32**/68/*0*) NA	TBD	28 (**92**/7/*1*)
Holistic	Blue Mountain East Cascade Siskiyou	3,991,282 (**49**/49/*2*)	782	F/L, M, S N/L, M, S Anadromous	5,434 (**38**/60/*2*) 14,578 (**39**/60/*2*) 2,103 (**22**/76/*3*)	361 872	28 (**92**/7/*1*)
Siskiyou	Siskiyou	1,001,491 (**39**/61/*1*)	409	F/M, S Anadromous	872 (**32**/68/*0*) 336 (**21**/79/*0*)	85	29 (**93**/7/*1*)

The department needs feedback from the Board regarding this matrix to help us understand both if this is a helpful framework to consider the various components related to each decision element and how they are interlinked.

4. References

Weikel, J and R Krahmer. 2006. *Compliance with Leave Tree and Downed Wood Forest Practices Act Regulations: Results from Pilot Study*. Oregon Department of Forestry Forest Practices Monitoring Section Technical Report #18.

Appendix 1. Supplemental information for the Board

Survey information

Table A1. Linking survey questions with the Forest Practices Act (FPA) or the Monitoring Strategy.

Question element		FPA (ORS or OAR)	Relevant questions
Geographic region		OAR 629-635-0220	3, 4
Topic	Water quality	OAR 629-635-0100(1) and ORS 527.765	5-9
	Healthy forests	OAR 629-640-0100	5-9
	Wildlife habitat	OAR 629-635-0100(1)	5-9
	Fish habitat	OAR 629-635-0100(1)	5-9
Stream type		OAR 629-635-0200(4)	10, 11
Stream size		OAR 629-635-0200(12)	12, 13
Information type		ORS 527.714(5)(a) and OAR 629-635-0110	14, 15

Information to include (questions 14 and 15)

Regarding the type of study information to include when addressing a question, over 75% of respondents selected four information types: peer-reviewed scientific articles, status and trend data on fish populations, streamside and fish habitat data, and voluntary measures on non-federal lands (Figure A1). The other three defined information types (white papers, Total Maximum Daily Load analyses, and watershed council analyses) were selected by 50-75% of respondents. For the "Other" category (selected by 40% of respondents), 18 respondents suggested to use particular sources (e.g., industry, university), two suggested to exclude certain sources, and the remainder focused on other ideas (e.g., "common sense" , "voluntary measures are inadequate") or suggested particular study methods. Responses from each of the largest groups approximate those of all groups combined. If the three groups with the highest number of respondents are filtered out (industrial landowners, conservation, and other), the results are similar.

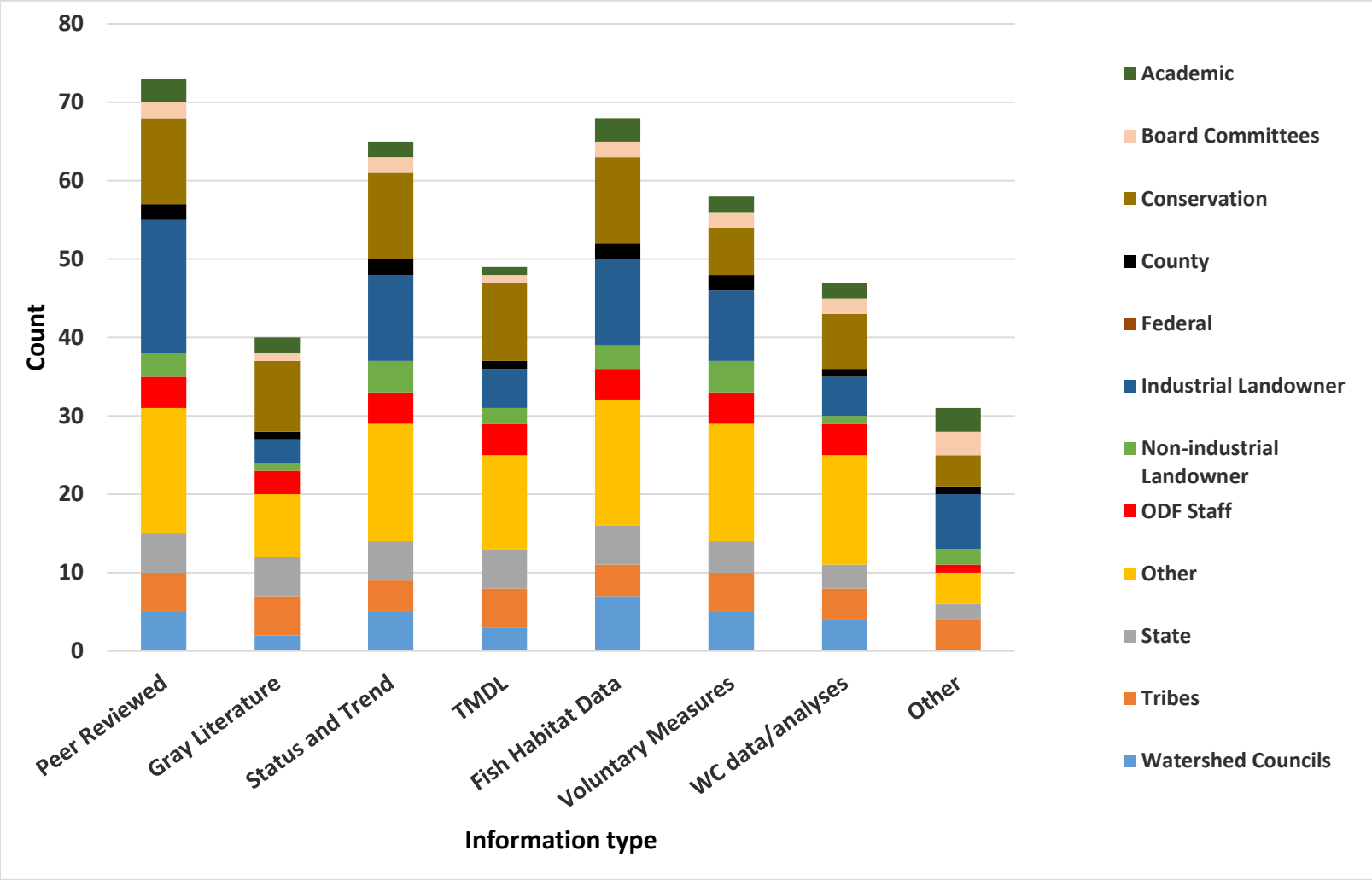

Figure A1. Number of respondents that selected each information type (question 14). Seven survey respondents did not answer this question. (TMDL) total maximum daily load, (WC) watershed council.

Relating Board decisions to Monitoring Strategy Priorities

To help the Board with a decision on selection of the monitoring questions, the department is organizing a variety of information, including linkage of the Board decisions to high priority effectiveness questions in the 2016 Monitoring Strategy.

To help the Board narrow their decision-making space, it is helpful to consider their decisions within the context of the approved 2016 Monitoring Strategy. This approach is especially useful since the Strategy was developed via a methodical process, included much stakeholder input, and provides a solid framework to consider the Board's decisions. We therefore organized a matrix (Table A2) that links this Strategy with the Board's upcoming decisions for selecting monitoring questions. All monitoring question themes in Table 5 can be associated with at least one high priority question in the Strategy. The Holistic theme can be associated with aspects of three priority questions. The Simple, Domestic and Siskiyou themes are associated with only one high priority question.

Table A2. Monitoring question themes from Table 5 associated with high priority effectiveness monitoring questions from the 2016 Monitoring Strategy. Monitoring question themes may touch on only one or more aspects of a question from the Strategy to be considered associated.

Table 5 Question Theme	**Associated High Priority Effectiveness Question from 2016 Monitoring Strategy**
All themes	When implemented, how effective are (new) riparian prescriptions (voluntary or regulatory) at protecting water quality, providing large wood recruitment and attaining desired future conditions?
Majority, Holistic	What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? For the fraction that is not on this track, what are the causes (e.g., due to legacy, blow-down, lack of hardwood-to-conifer conversion, insufficient FPA compliance)? Do DFC targets translate into mature forest conditions that meet water quality standards and other goals?
Holistic	Are forest practice rules effectively protecting headwater (small Type N) streams such that local and downstream beneficial uses are protected? Key issues include effects on stream temperature, large wood recruitment, stream flow, sediment delivery, mass wasting initiation and debris torrent processes, macroinvertebrates, and how those effects are translated downstream.