

**Stakeholder Perceptions About the Health of the Athabasca Watershed:  
Results of a Preliminary On-line Survey**

Prepared as Part of Phase 2 of the Athabasca State of the Watershed Report



**Prepared for:**

Athabasca Watershed Council  
P. O. Box 5066, HINTON, AB  
T7V 1X3

Attn: Connie Simmons, Executive Director

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**Prepared by Fiera Biological Consulting**

200, 10318-82 Avenue | Edmonton, AB T6E 1Z8 | Tel: (780) 466.6554 | Fax: (780) 466.9134 | W: [fieraconsulting.ca](http://fieraconsulting.ca)

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## 1.0 Introduction

As a designated Watershed Planning and Advisory Council (WPAC), the Athabasca Watershed Council has been mandated by the provincial government to develop a State of the Watershed (SoW) Report for the Athabasca Watershed. A key component of the SoW Report includes obtaining information from stakeholders who live and work in the watershed, to better understand their perceptions around how various anthropogenic pressures may be threatening aquatic ecosystems and watershed health. As such, the key objective of this component of the Athabasca State of the Watershed Report was to engage a broad range of stakeholders to elicit personal and organizational knowledge about specific risks (pressures) to watershed health within the Athabasca Watershed, as well as individual subwatersheds.

This survey was done in parallel with the selection and modeling of ecological criteria and indicators in the Athabasca Watershed (Fiera Biological 2012). Criteria are categories of conditions or processes that characterize the aquatic environment and can be used to evaluate watershed condition, while indicators are measureable (quantitative) or descriptive (qualitative) variables that can be used to observe, evaluate, or describe trends as a criterion changes over time. Following the development of the list of criteria and indicators by the Athabasca Watershed Council Technical Committee, this survey was launched to gather stakeholder feedback on a subset of the indicators that were selected to model the state of the Athabasca Watershed. The intent behind this approach was to use the information gathered from the survey to help inform the weighting of indicators in the development a Watershed Health Index. While this was the original intent behind the survey, subsequent changes in the overall approach to modeling watershed indicators, coupled with the low response rate for the survey, meant that the survey results have not been used in the development of an overall Watershed Health Index. Despite this, the results from this survey give the Athabasca Watershed Council important information regarding stakeholder perceptions about anthropogenic risk and pressures that may be impacting watershed health, and insights into stakeholder perceptions about the challenges, barriers, and solutions that are needed to improve management of the Watershed.

## 2.0 Methods

Given the diversity and geographic dispersion of key stakeholders, an online survey was administered to key informants who live and/or work in the watershed using the open source survey software LimeSurvey (2012). Study and question design followed accepted qualitative methodologies for web-based surveys (Dillman 2007). Working in consultation with the Athabasca Watershed Council, a list of key informants was compiled, with an effort made to select a representative number of key informants by both subwatershed and stakeholder group. Key informants were defined as being people who lived and/or worked in the Athabasca Watershed, and had a better than average understanding of water and watershed management issues. Prior to administering the survey, a pre-test with members of the Athabasca Watershed Council Technical Committee was conducted to ensure that survey questions were clear and the instructions for conducting the survey were understandable. Modifications to both the wording and order of questions were made as a result of the pre-test feedback. None of the pre-test responses were included in the final results.

An invitation letter was sent to each participant via email on November 15, 2011. The invitation provided rationale for the survey, as well as a general description of the goals and objectives of



the survey. The invitation letter also explained that participation was voluntary, and that the survey was anonymous, with all responses being held in strict confidence. In order to control access to the survey, each participant was assigned a randomly generated token that was required at the time of survey log-on. This token was sent to each participant in the invitation letter and upon completion of the survey, all identifying features, including the token number, were stripped from individual responses.

The survey was active on-line between November 15 and December 23, 2011. Email reminders were sent out to participants on November 28 and December 19, 2011. Participants who had not completed the survey by December 2 were contacted via telephone by a representative of the Athabasca Watershed Council and were invited to complete the survey. These phone calls revealed that four of the participants had not received the initial email invitation; thus, a second email invitation was sent to these participants.

The survey consisted of four parts (see Appendix A for a complete copy of the survey):

Part 1 focused on questions related to the participants experience in, and knowledge of, the Athabasca Watershed.

Part 2 focused on uncovering participants' perceptions about how key anthropocentric pressures may be impacting subwatershed health. Each participant was asked to identify the subwatershed(s) that they were most familiar with, and for each subwatershed selected, participants were asked to rate a list of 15 key pressures according to how severely they thought each pressure affected watershed health. Participants were asked to rate each pressure using a scale ranging from 1 (Negligible) to 5 (Very High). An open-ended question also invited participants to add additional pressures that they thought may have been missing from the list. Finally, participants were asked to rate the current health of the subwatershed on a five-point scale, ranging from Poor to Very Good.

Part 3 of the survey focused on evaluating the list of pressures at the scale of the entire Athabasca Watershed. Because this question was focused on assessing watershed condition at such a large scale, we recognized that not all participants would have the experience and knowledge to respond to this question. Thus, participants were asked (yes or no) whether they would like to rate the list of key pressures for the whole Athabasca Watershed. If they responded "yes", they were asked to rate the list of 15 pressures using the same scale as in Part 2 of the survey.

Part 4 of the survey asked participants to identify what they considered to be the most significant challenge(s) for maintaining (or improving) watershed health, as well as listing what they considered to be the most important management change(s) that needed to be made over the next several years to ensure long-term health of the Athabasca Watershed. Lastly, participants were invited to provide any final thoughts.



### 3.0 Results

#### Response Rates

In total, 40 participants were invited to complete the survey and 26 full responses were received, for a response rate of 65%<sup>1</sup>. Of those who responded, over half indicated that they were representatives of either Government (7 individuals) or a Non-government Organization (NGO; 7), while the remaining respondents self-identifying as Industry (5), Aboriginal (2), or “Other” (5) (Figure 1). Those who classified themselves as being in the “Other” category self-identified as being one of the following: Former NGO, Environmentalist, Citizen, Independent Scientist, and Earth Citizen.

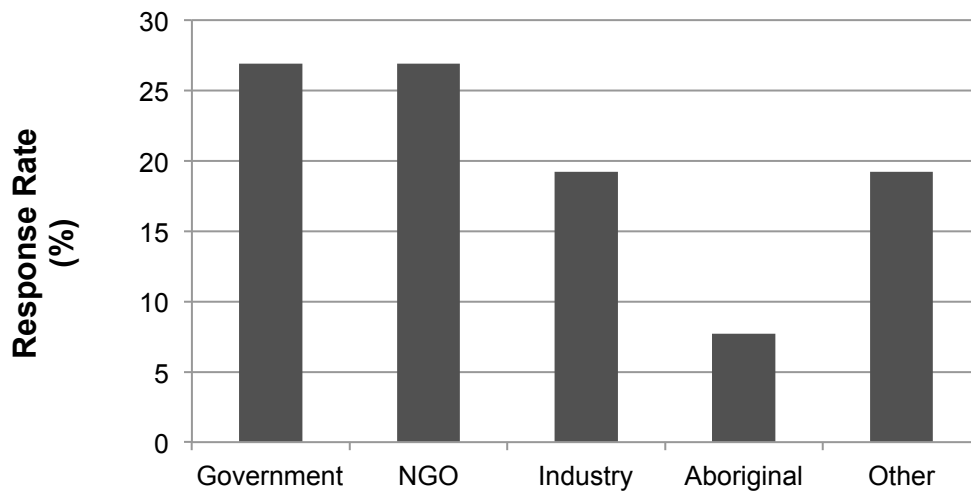


Figure 1. Percentage of survey respondents categorized by stakeholder group (n=26).

When survey respondents were asked to identify the individual subwatersheds that they were most familiar with, and for which they were comfortable providing their option on how various anthropogenic pressures might be impacting subwatershed health, response rates were highest for the Lower Athabasca, Upper Athabasca, and the Clearwater subwatersheds (Figure 2). Response rates were lowest for the Lake Athabasca and the Central Athabasca-Upper subwatersheds. Within the various stakeholder groups, respondents who self-identified as NGO provided pressure ratings for all 10 subwatersheds, while Government provided ratings for 9 subwatersheds, Industry for 6 subwatersheds, Aboriginal for 4 subwatersheds, and Other for 8 of the 11 subwatersheds (Table 1). Only the Lower Athabasca and the Clearwater subwatershed had ratings provided by at least one respondent from each stakeholder group, as did the Athabasca Watershed as a whole (Table 1).

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<sup>1</sup> Two participants opted out of the survey and three participants started, but did not complete the survey.

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Table 1. Total number of participants, categorized by stakeholder group, who provided their option on how selected anthropogenic pressures are impacting subwatershed and watershed health. The Lower Athabasca, Clearwater, and the Athabasca were the only watersheds for which pressure indicators were rated by at least one member of each stakeholder group.

Subwatershed Name	Stakeholder Group					TOTAL
	Government	NGO	Industry	Aboriginal	Other	
Lake Athabasca	1	1	1	0	1	4
Lower Athabasca	1	3	3	2	3	12
Central Athabasca – Lower	1	3	0	1	2	7
Clearwater	1	3	2	2	2	10
Lesser Slave	1	1	1	0	2	5
Central Athabasca -Upper	0	2	0	0	2	4
La Biche	1	2	0	1	1	5
Pembina	1	2	0	0	2	5
McLeod	1	2	3	0	1	7
Upper Athabasca	4	2	2	0	1	9
<b>Athabasca Watershed</b>	3	6	2	2	3	16
<b>TOTAL</b>	15	27	14	8	20	84

The distribution and range of scores for the perceived severity of impact of the various pressure indicators was examined to better understand how perceptions differed amongst stakeholder groups (Figure 3). When all scores for the perceived severity of impact were combined the results revealed that those who self-identified as Aboriginal or Other tended to score pressures higher than all other stakeholder groups, with those who self-identified as Industry consistently scoring pressures lower than other stakeholder groups (Figure 3A). The distribution of responses reported by participants who self-identified as NGO closely resembled a normal distribution, with a median score of 3 (Moderate). While the median score for Government stakeholders was also 3, the distribution of responses was skewed more towards scores of 1 or 2 (Figure 3A).

When scores for perceived impacts to health were combined for subwatersheds and the Athabasca Watershed, the results revealed that those who self identified as Aboriginal and Other consistently scored watershed health lower than other stakeholder groups (Figure 3B). Those who self identified as NGO and Government tended to have the largest range in health scores, while Industry stakeholders tended to score watershed health as Good (4) in nearly every instance (Figure 3B).



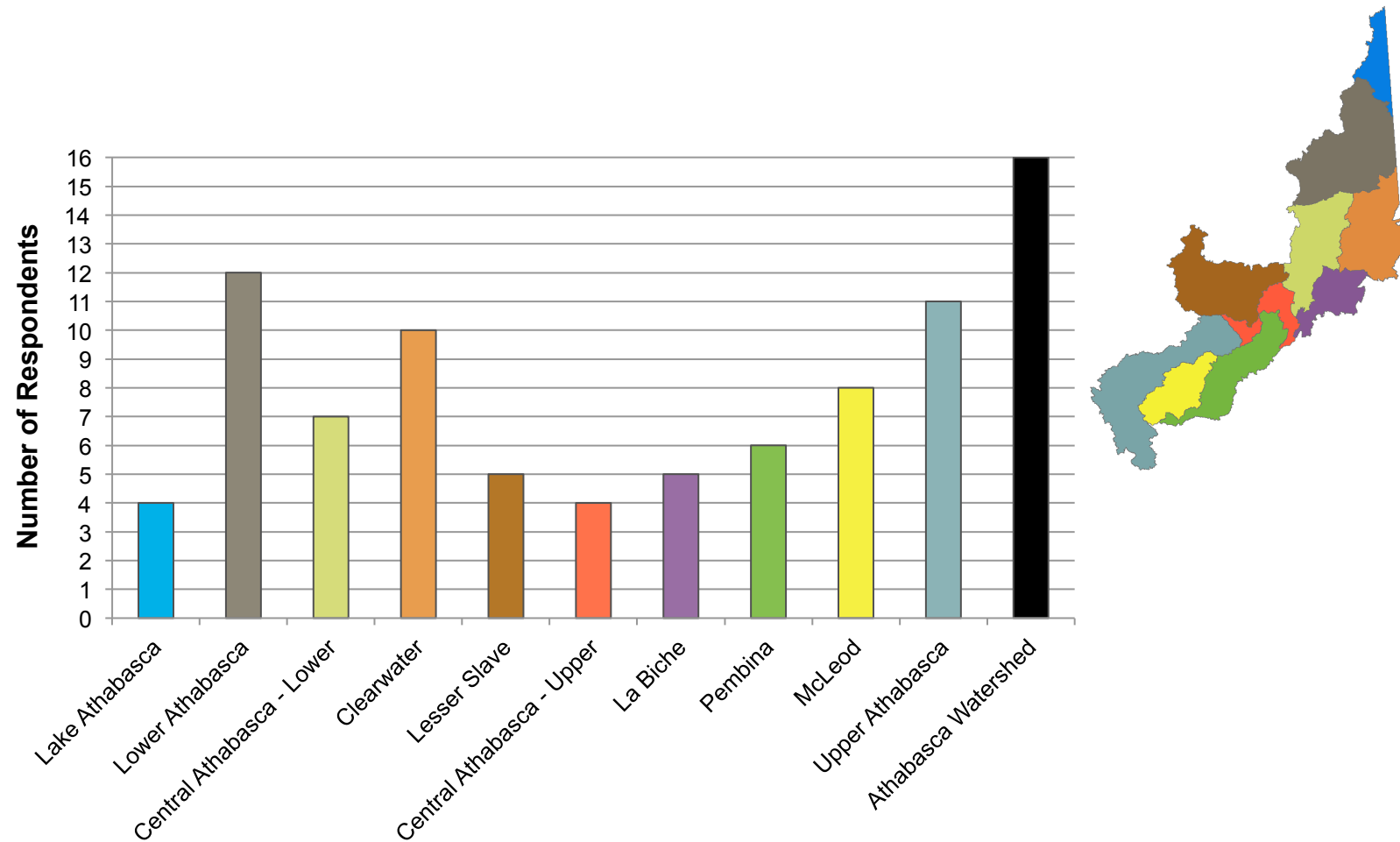


Figure 2. The number of respondents who rated anthropogenic pressures for each subwatershed, as well as for the Athabasca Watershed as a whole.





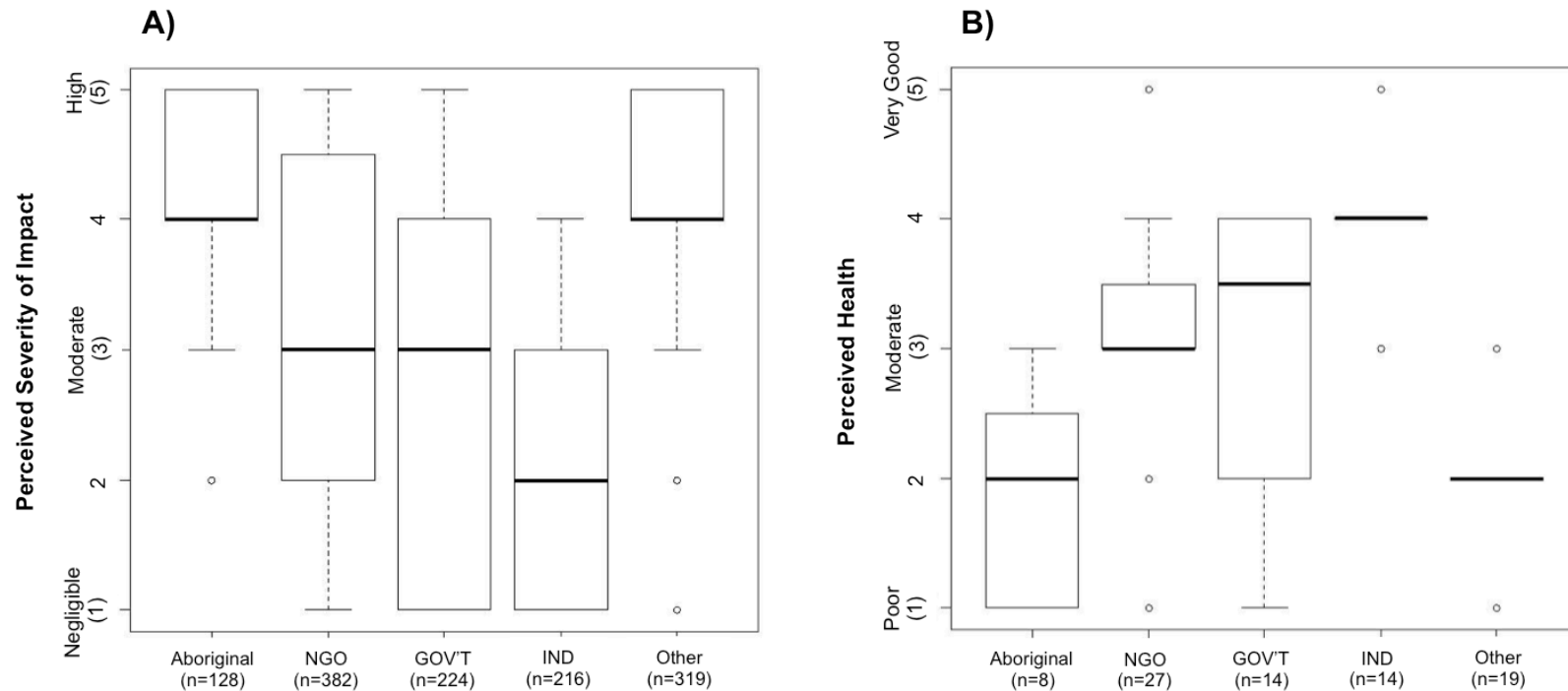


Figure 3. Distribution of scores for perceived severity of impact ratings combined for all all subwatersheds and the Athabasca Watershed, presented by stakeholder group (A), as well as the distribution of perceived health ratings for all subwatersheds and the Athabasca Watershed combined (B). The dark solid line indicates the median (middle) value (i.e., half of the values are above and half are below the median), while the extent of the box indicates the upper quartile (i.e., three-quarters of the data are below this value) and lower quartile (i.e., 25% of the data falls below this value). The tails illustrate both the minimum and maximum data values, and the open circles depict outliers (i.e., values that is numerically distant from the rest of the data). The number of observations (n) included in the analysis is presented for each stakeholder group.



### **Impact Severity Rating**

In order to evaluate and compare stakeholder perceptions about how severely each of the selected pressures are impacting subwatershed health, impact scores were collapsed down from a five-point scale to a three-point scale, with scores of 1 and 2 combined into a “Negligible” category, a score of 3 categorized as “Moderate”, and scores of 4 or 5 combined into a “High” category. The proportion of responses falling into each category was then calculated by subwatershed for each of the 15 anthropogenic pressures evaluated.

When only those scores rated as High (4) or Very High (5) are considered, it is possible to see which pressures have been identified by stakeholders as being of greatest concern by subwatershed (Table 2). For example, 75% of stakeholders who responded feel that surface and subsurface mining is having a High or Very High severity of impact on watershed health in the Lower Athabasca subwatershed, while this number rises to 81% of respondents when asked about the severity of impact of mining at the scale of the entire Athabasca Watershed (Table 2). Full results, including the full range of severity rating (Negligible, Moderate, and High) for each subwatershed presented by anthropogenic pressure can be found in Appendix B.

When asked about the severity of impact of anthropogenic pressures on the health of the Athabasca Watershed as a whole, those who responded (n=16) appeared most concerned about the effects of surface and subsurface mining, habitat loss (wetlands, streams, riparian habitat), water use, and lake acidification (Tables 2 and 3).



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Table 2. Proportion (%) of respondent who rated the severity of impact as High (4) or Very High (5) for each of the 15 anthropogenic pressures considered in the survey. The total number of participants that responded for each subwatershed is reported (n-value).

	Lake Athabasca (n=4)	Lower Athabasca (n=12)	Central Athabasca – Lower (n=7)	Clearwater (n=10)	Lesser Slave (n=5)	Central Athabasca – Upper (n=4)	La Biche (n=5)	Pembina (n=6)	McLeod (n=8)	Upper Athabasca (n=10)	ATHABASCA Watershed (n=16)
Roads, seismic lines, & other linear disturbance	25	58	43	70	40	75	80	67	25	20	50
Agricultural land use	0	0	14	10	60	50	60	50	13	10	19
Surface & subsurface mining	25	75	57	70	40	50	60	33	38	20	81
Commercial forest harvest	25	42	57	60	40	75	80	33	25	20	44
Urban expansion	0	25	14	30	40	75	60	50	13	10	19
Population growth	0	33	29	40	40	75	60	67	25	20	25
Loss or fragmentation of riparian habitat	25	67	57	60	40	100	60	67	38	20	63
Loss or fragmentation of stream habitat	25	58	57	60	40	100	60	67	38	20	63
Pollution or nutrients from point sources	50	58	43	40	60	75	60	67	63	50	63
Pollution or nutrients from land runoff	50	50	43	30	60	50	60	50	25	10	44
Changes in average annual temperature & precipitation	25	25	43	40	60	75	40	67	38	40	50
Loss of wetlands	25	67	57	52	40	75	60	83	38	40	69
Diversion & use of surface water	25	50	29	50	40	75	60	67	25	20	63
Withdrawal & use of groundwater	25	50	43	70	40	75	60	50	13	10	56
Acidification of Lakes	25	50	43	40	40	75	60	67	13	20	50



Table 3. Proportion (%) of respondent who rated the severity of impact as Negligible (1 or 2), Moderate (3), or High (4 or 5) for each of the 15 anthropogenic pressures in the Athabasca Watershed (n=16).

	Negligible	Moderate	High	Don't Know
Roads, seismic lines, & other linear disturbance	13	38	50	0
Agricultural land use	50	31	19	0
Surface & subsurface mining	13	6	81	0
Commercial forest harvest	25	31	44	0
Urban expansion	56	25	19	0
Population growth	50	25	25	0
Loss or fragmentation of riparian habitat	25	6	63	6
Loss or fragmentation of stream habitat	19	6	63	13
Pollution or nutrients from point sources	19	13	63	6
Pollution or nutrients from land runoff	25	25	44	6
Changes in average annual temperature & precipitation	38	0	50	13
Loss of wetlands	25	6	69	0
Diversion & use of surface water	25	13	63	0
Withdrawal & use of groundwater	25	13	56	6
Acidification of Lakes	25	13	63	0

### Watershed Health

After scoring the list of anthropogenic pressures according to perceived severity of impact for each selected subwatershed, participants were asked to rate the current health of the subwatershed, as well as the current health of the Athabasca Watershed. Watershed health scores were collapsed down from a five-point scale (Poor, Fair, Moderate, Good, Very Good) to a three-point scale, with scores of Poor and Fair being combined into a Poor/Fair category, and scores of Good and Very Good being combined into a Good/Very Good category. Respondents were also presented with a “Don’t Know” category. The proportion of responses falling into each category was then calculated for each subwatershed and for the Athabasca Watershed (Table 4; Appendix C).

Table 4. Proportion (%) of respondent who rated the current health of the subwatershed and Athabasca Watershed as Poor/Fair, Moderate, Good/Very Good, or Don't Know.

	Poor/Fair	Moderate	Good/Very Good	Don't Know
Lake Athabasca (n=4)	50	0	50	0
Lower Athabasca (n=12)	58	8	25	8
Central Athabasca – Lower (n=7)	14	43	43	0
Clearwater (n=10)	30	20	50	0
Lesser Slave (n=5)	20	60	20	0
Central Athabasca – Upper (n=4)	50	50	0	0
La Biche (n=5)	80	0	20	0
Pembina (n=6)	67	17	0	17
McLeod (n=8)	25	38	25	13
Upper Athabasca (n=10)	10	40	40	10
ATHABASCA WATERSHED (n=16)	38	31	31	6



The majority of respondents considered the current health in the Lower Athabasca, La Biche, and the Pembina to be Poor/Fair, while the majority of respondents considered the current health of the Central Athabasca – Lower, Clearwater, Lesser Slave, McLeod, and the Upper Athabasca to be Moderate or Good/Very Good (Table 4). Opinions about the current health of the Lake Athabasca and the Central Athabasca – Upper were more disjunct, with little agreement amongst respondents about the status of the health in these subwatersheds. Interestingly, respondents were most uncertain about the current health of the Pembina, followed by the McLeod, and the Upper Athabasca subwatershed. When asked about the current health of the Athabasca Watershed, responses were nearly equal across all categories, with a slightly higher number of respondents indicating that the current health was Poor/Fair (Table 4). Please see Appendix C for Figures displaying results for current health scores.

### **Management Challenges and Recommendations**

When respondents were asked to identify the most significant challenge(s) for maintaining or improving watershed health in the Athabasca Watershed, five notable themes emerged:

1. Continued use of ground and surface water for industrial purposes (e.g., agriculture and oil sands).
2. Impairment of water quality through municipal and industrial discharges
3. A need to coordinate the development and implementation of policy and regulation between industry (i.e., agriculture, forestry, oil and gas), government (i.e., municipal, provincial, federal), and other stakeholders (e.g., First Nations and WPACs). This includes a need for increased education and awareness, as well as changing what some respondents perceive as being an overly-permissive attitude towards allowing industrial development to proceed without due consideration of cumulative effects and risks associated with climate change.
4. A lack of transparent, scientifically legitimate environmental monitoring and assessment programs.
5. An undervaluation of natural habitats, such as forests and wetlands (and specifically peatlands).

When respondents were asked to identify the most important management change(s) that need to be made over the next several years to ensure the long-term health of the Athabasca Watershed, the following themes were noted most frequently:

1. Monitoring programs need to be improved, such that they are impartial, independent, transparent, and better coordinated between agencies. This information should be used as a baseline for monitoring changes in the watershed over time.
2. Approvals for water use should not be issued without sufficient scientific understanding of the status of the resource, including the maintenance of minimal ecological flows to sustain healthy aquatic ecosystems.
3. Development, implementation, and enforcement of science-based provincial regulations, policies, and/or management frameworks that address water quality and quantity, wetlands, land reclamation, and biodiversity. This should include sufficient government resources to adequately evaluate applications and enforce approval conditions, including prosecution of violators.



4. More intentional planning with improved and more scientifically legitimate standards for conducting Environmental Impact Assessments. EIAs that demonstrate environmental harm, or a risk thereof, should not be granted.

The full range of responses to these questions, as well as more general comments made by respondents, is presented in Appendix C. Note that the full response of each participant is presented in the Appendix, with only minor edits made to correct for spelling and grammar.

## **5. Conclusion**

These results provide insights into the perceptions of 26 stakeholders regarding the current state of the Athabasca Watershed and its 10 subwatersheds. Given the low number of participants included in this survey, these results should be interpreted with caution, as they do not necessarily reflect the general perceptions of the larger population of stakeholders in the watershed. However, this survey does provide the Athabasca Watershed Council with additional information about how perceptions may vary by stakeholder group, and what stakeholders perceive to be the major challenges for maintaining watershed health, as well as the opportunities for improving watershed management over the short-term. This information can be used to help inform and focus future stakeholder consultation as the Athabasca Water Council moves forward in the development of an Integrated Watershed Management Plan. In order to ascertain whether the differences in stakeholder perceptions uncovered by this work represents a general pattern amongst stakeholder groups, additional survey work should be considered. This work should utilize a valid sampling frame and a statistically robust sample size. If additional survey work reveals similar differences in perceptions amongst stakeholder groups, this would point to the need for more robust and extensive science-based information to help resolve differences in perceptions regarding the future direction of management in the Athabasca Watershed.

## **6. Literature Cited**

- Dillman, D.A. 2007. Mail and internet surveys: The tailored design method. Second Edition, John Wiley & Sons, Inc. Hoboken, New Jersey.
- Fiera Biological Consulting Ltd. 2012. Athabasca State of the Watershed Report: Phase 2. Report Prepared for the Athabasca Watershed Council.
- LimeSurvey Project Team. 2012. / LimeSurvey: An Open Source survey tool version 1.91 build 12170; /LimeSurvey Project Hamburg, Germany. URL <http://www.limesurvey.org>



## **Appendix A: Survey**



## **PART 1: Participant Experience and Knowledge**

1.1 What stakeholder group do you represent? \*

- ☐ Government
- ☐ Non-government organization
- ☐ Industry
- ☐ Aboriginal
- ☐ Other: \_\_\_\_\_

1.2 Please tell us where in the Athabasca Watershed you spend most of your time. For example, in which subwatershed(s) do you live, work, or recreate? Please select all that apply.

You can select the subwatershed by checking any of the boxes that apply in the list below, or you can select all relevant watersheds by clicking on the map. You can move and zoom the map by using the navigation pane on the left side of the map. You can also navigate by clicking on and dragging the map.

Please choose **all** that apply:

- ☐ Central Athabasca - Lower
- ☐ Central Athabasca - Upper
- ☐ Clearwater
- ☐ La Biche
- ☐ Lake Athabasca
- ☐ Lesser Slave
- ☐ Lower Athabasca
- ☐ McLeod
- ☐ Pembina
- ☐ Upper Athabasca





## **PART 2: Evaluating Key Pressures on Subwatershed Health**

2.1 Impacts to watershed health can vary significantly by location. Because of this, we are interested in better understanding how key pressures (e.g. linear disturbance, point source pollution, livestock density, etc.) are affecting the health of individual subwatersheds in the Athabasca River basin.

We are interested to know your opinion about how severely you feel various pressures may be impacting subwatershed health. Again, in the context of this survey, watershed health is considered to be a combination of elements that together constitute an ecologically functional watershed, including: biological diversity; surface water quality; ecologically significant water levels and flows; and groundwater quality and quantity. On the map below, please select the subwatershed(s) that you are most familiar with, and for which you are comfortable providing your opinion. Please note that you may select more than one subwatershed. If you do not want to provide your opinion, please select “Not Applicable”.

Please choose **all** that apply:

- ☐ Central Athabasca - Lower
- ☐ Central Athabasca - Upper
- ☐ Clearwater
- ☐ La Biche
- ☐ Lake Athabasca
- ☐ Lesser Slave
- ☐ Lower Athabasca
- ☐ McLeod
- ☐ Pembina
- ☐ Upper Athabasca
- ☐ Not Applicable

[FOR *EACH* SUBWATERSHED SELECTED, RESPONDANT WAS ASKED QUESTIONS 2.2 through 2.4]



2.2 From the list below, please rate the following pressures according to how severely you think they affect the health (i.e., biological diversity, surface water quality; ecologically significant water levels and flows; and groundwater quality and quantity) of the [NAME OF SUBWATERSHED].

Pressures rated as “Very High” are considered to be significant negative impacts that irreversibly affect watershed health. Pressures rated as “Moderate” are considered to be serious negative impacts with the potential to significantly affect watershed health without active management. Pressures rated as “Negligible” are considered to have little or no impact on watershed health.

	Not Applicable	Negligible 1	2	Moderate 3	4	Very High 5	Don't Know
Roads, seismic line, and other linear disturbance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agricultural land use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surface and subsurface mining (e.g., coal, bitumen, gravel, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Commercial forest harvest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban expansion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Population growth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss or fragmentation of riparian habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss or fragmentation of stream habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollution or nutrients from point sources (e.g., industrial or municipal effluents)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollution or nutrients from land runoff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Changes in average temperature or the amount of annual precipitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss of wetlands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diversion and use of surface water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Withdrawal and use of groundwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acidification of lakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.3 Are there any additional pressures that you feel are important, but have not been included in the list above?

2.4 In general, how would you rate the current health of the [NAME OF WUBWATERSHED]?

	Very Good	Good	Moderate	Fair	Poor	Don't Know
Current Health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



### PART 3: Evaluating Pressures on Watershed Health in the Athabasca Basin

3.1 Pressures and activities that occur in each of the individual subwatersheds cumulatively affect the health of the Athabasca Watershed. We would like to know how severely you think the various pressures are impacting the health of the Athabasca Watershed.

Would you like to rate the list of key pressures for the entire Athabasca Watershed?

☐ Yes ☐ No (if no, Respondent skips to Question 4.1)

3.2 From the list below, please rate the following pressures according to how severely you think they affect the health (i.e., biological diversity, surface water quality; ecologically significant water levels and flows; and groundwater quality and quantity) of the Athabasca Watershed. While some of these pressures may vary by location, we are interested in how you think these impacts affect the **overall health** of the Athabasca Watershed.

Pressures rated as “Very High” are considered to be significant negative impacts that irreversibly affect watershed health. Pressures rated as “Moderate” are considered to be serious negative impacts with the potential to significantly affect watershed health without active management. Pressures rated as “Negligible” are considered to have little or no impact on watershed health.

	Not Applicable	Negligible 1	2	Moderate 3	4	Very High 5	Don't Know
Roads, seismic line, and other linear disturbance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agricultural land use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surface and subsurface mining (e.g., coal, bitumen, gravel, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Commercial forest harvest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban expansion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Population growth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss or fragmentation of riparian habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss or fragmentation of stream habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollution or nutrients from point sources (e.g., industrial or municipal effluents)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollution or nutrients from land runoff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Changes in average temperature or the amount of annual precipitation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss of wetlands	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diversion and use of surface water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Withdrawal and use of groundwater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acidification of lakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



3.3 Are there any additional pressures that you feel are important, but have not been included in the list above?

3.4 In general, how would you rate the current health of the Athabasca Watershed?

	Very Good	Good	Moderate	Fair	Poor	Don't Know
Current Health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### **PART 4: Follow-up Questions**

Managing the health of the Athabasca Watershed is a complex task that includes consideration of various environmental, social, and economic issues. We are interested in your opinions on what the key challenges and opportunities are for managing the Athabasca Watershed for future generations.

4.1 What do you see as the most significant challenge(s) to maintaining (or improving) watershed health in the Athabasca Watershed?

4.2 In your opinion, what is (are) the most important management change(s) that needs to be made in the next several years to ensure the long-term health of the Athabasca Watershed?

4.3 Do you have any final thoughts or comments that you would like to share?

The Athabasca Watershed Council would like to thank you for your participation in this survey. The information collected will be used to help inform the State of the Watershed Report that is currently being drafted. If you have any questions about this survey or the State of the Watershed Report, you can contact the following people:

#### **Athabasca Watershed Council**

Marilou Montemayor Watershed Science Coordinator

780-865-8223

[marilou.montemayor@awc-wpac.ca](mailto:marilou.montemayor@awc-wpac.ca)

#### **Fiera Biological Consulting Ltd.**

Shari Clare Sr. Biologist

780-466-6554

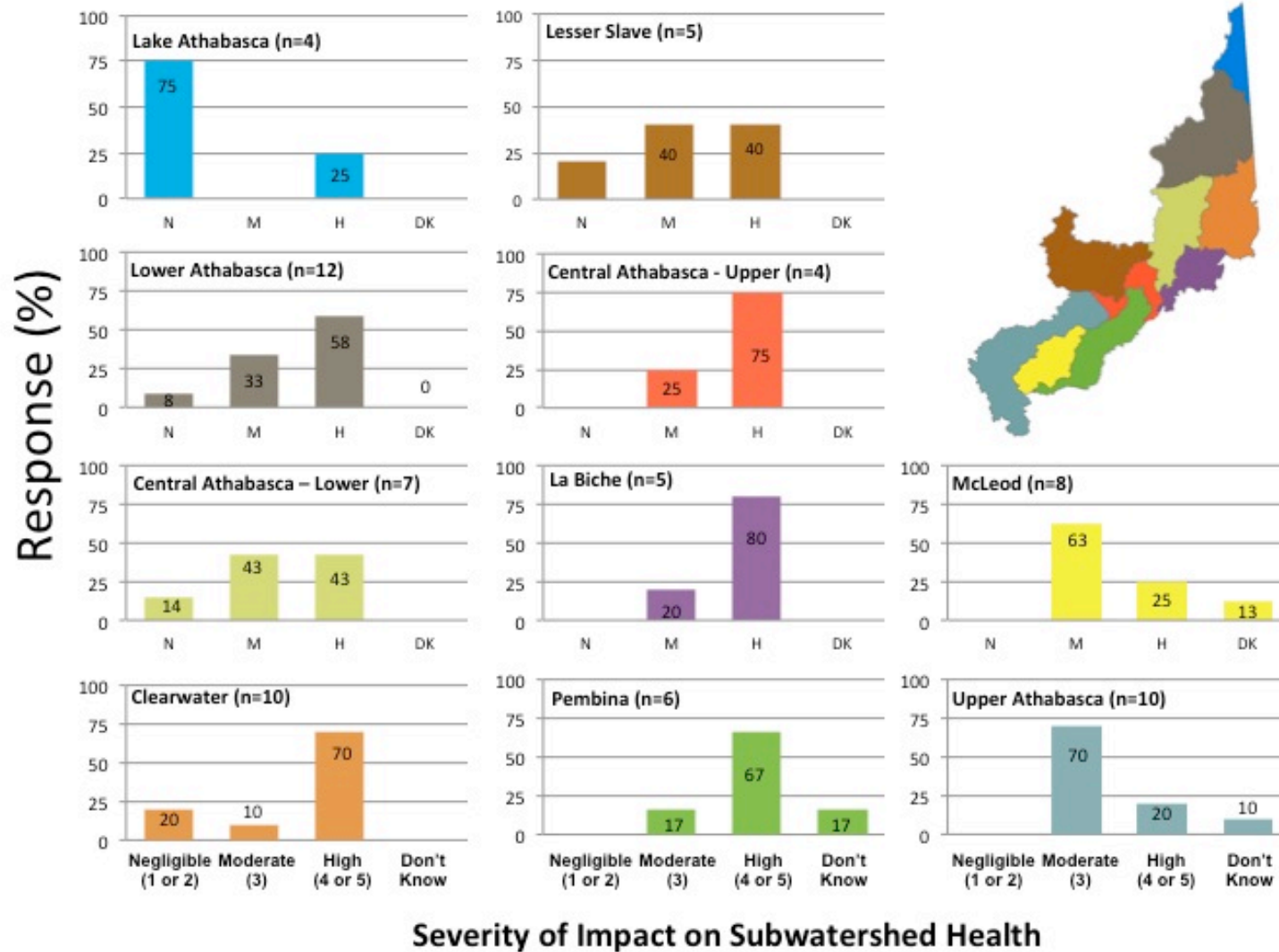
[sclare@fieraconsulting.ca](mailto:sclare@fieraconsulting.ca)



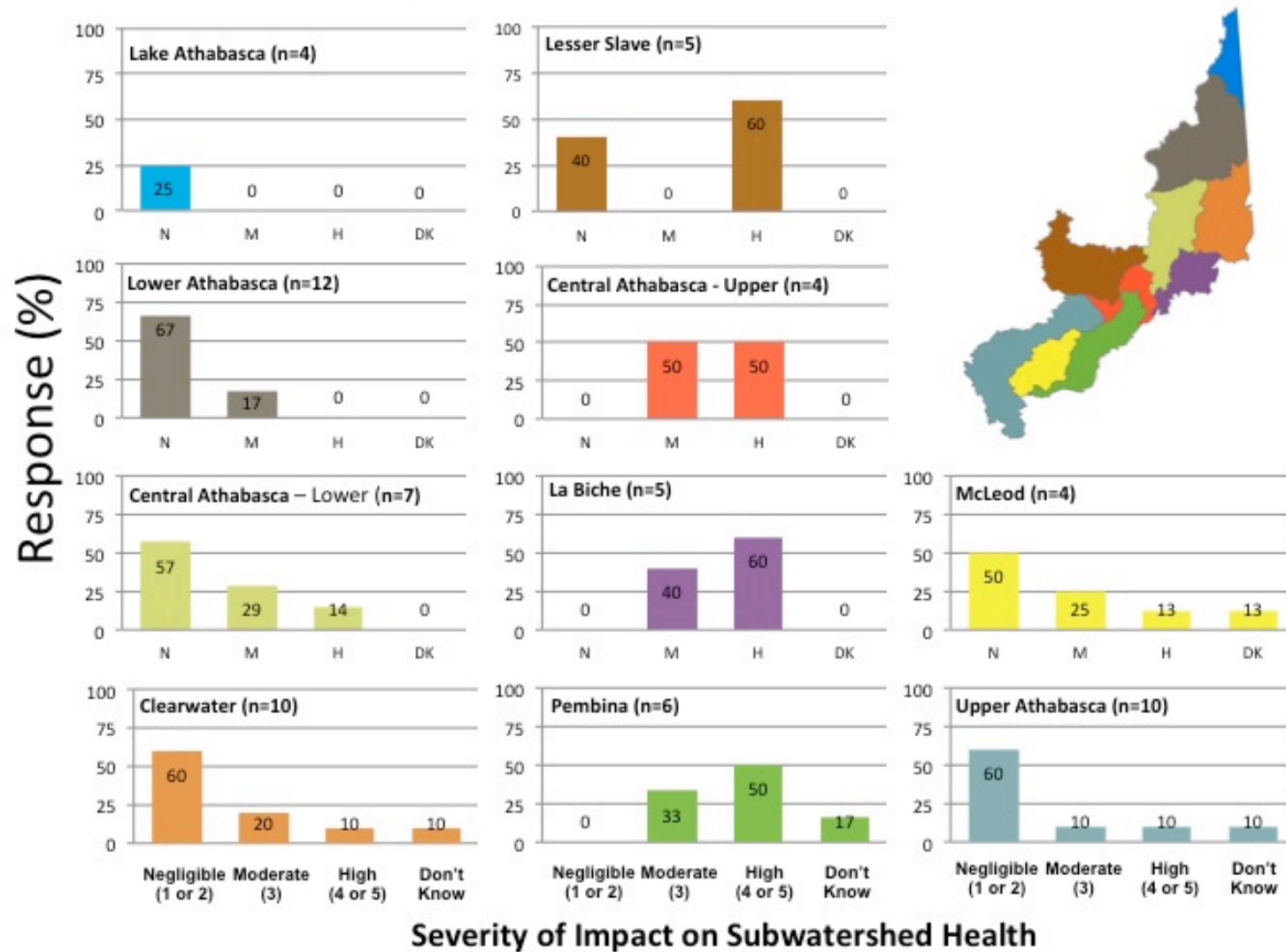
## **Appendix B: Impact Severity Figures**



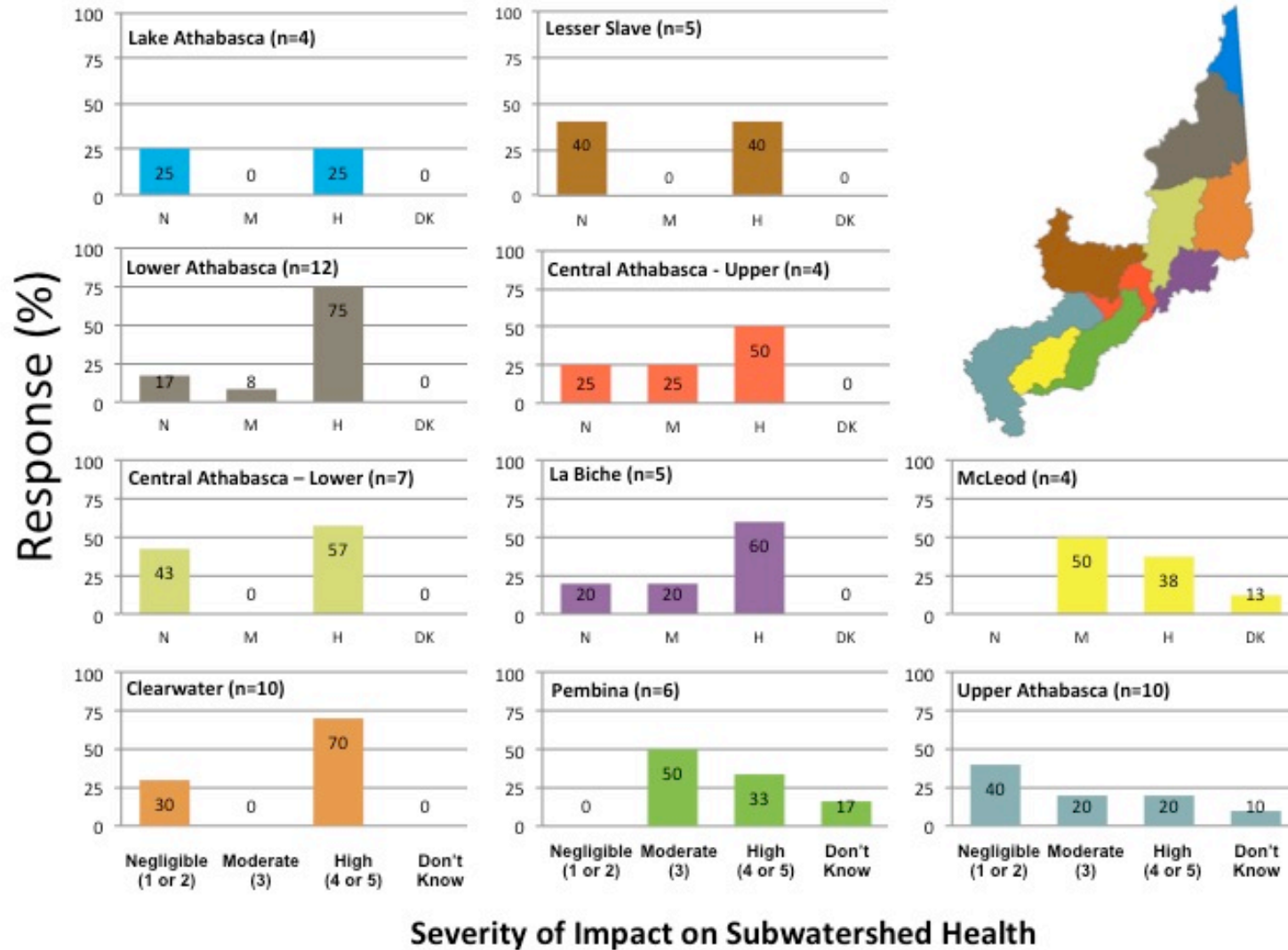
## Roads, Seismic Line, and Other Linear Disturbance



## Agricultural Land Use

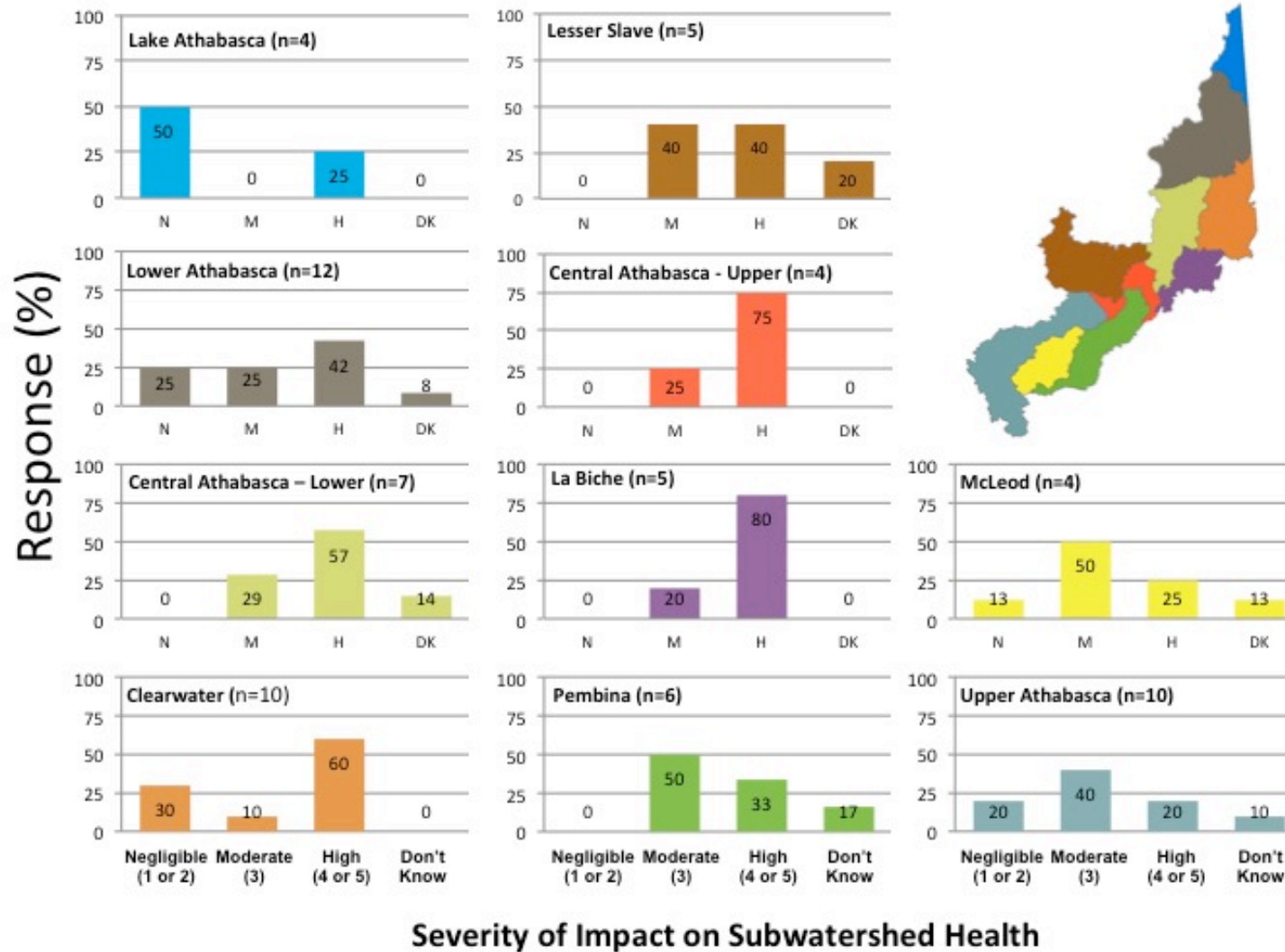


## Surface and subsurface mining

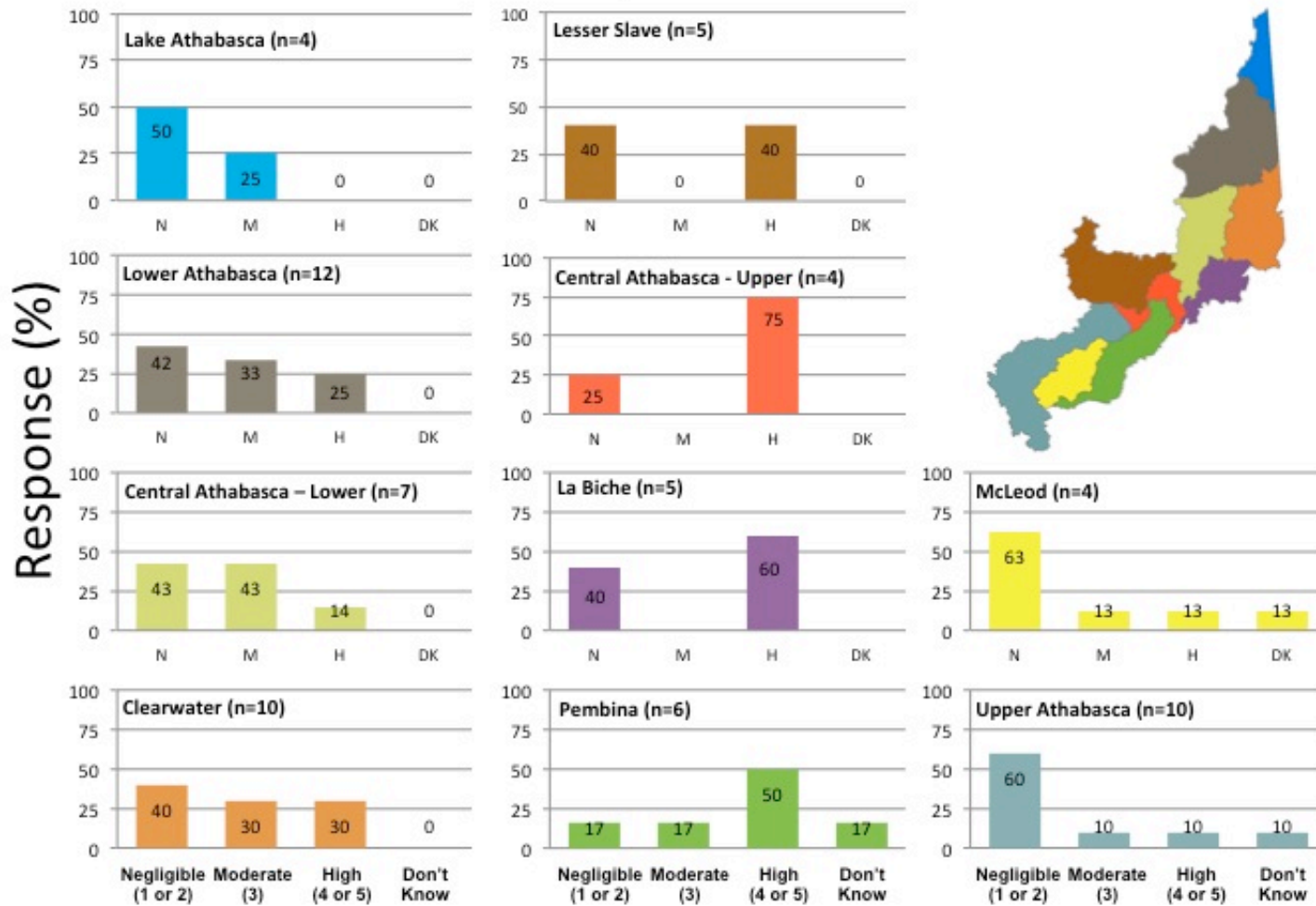




## Commercial Forest Harvesting



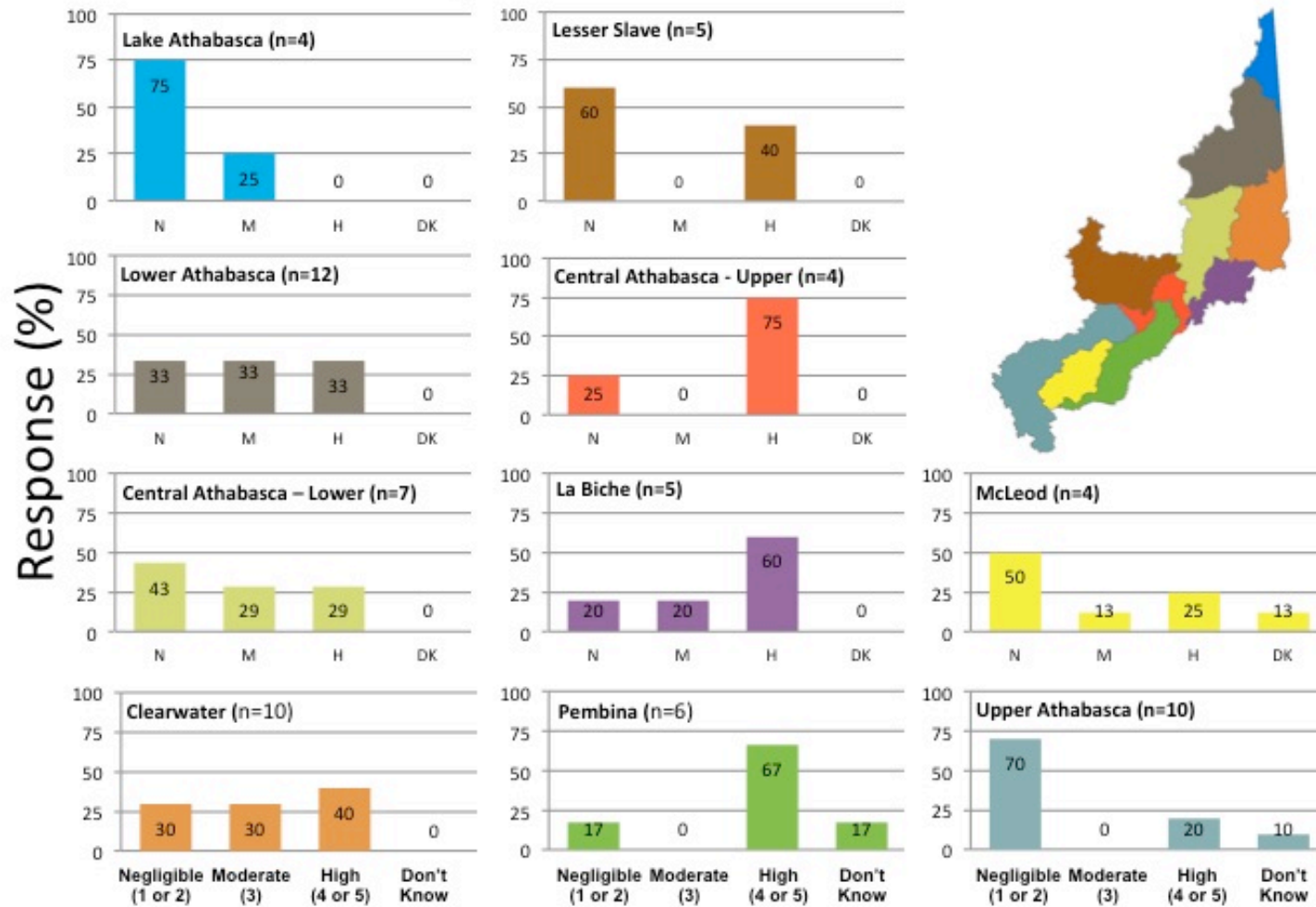
## Urban Expansion



## Severity of Impact on Subwatershed Health

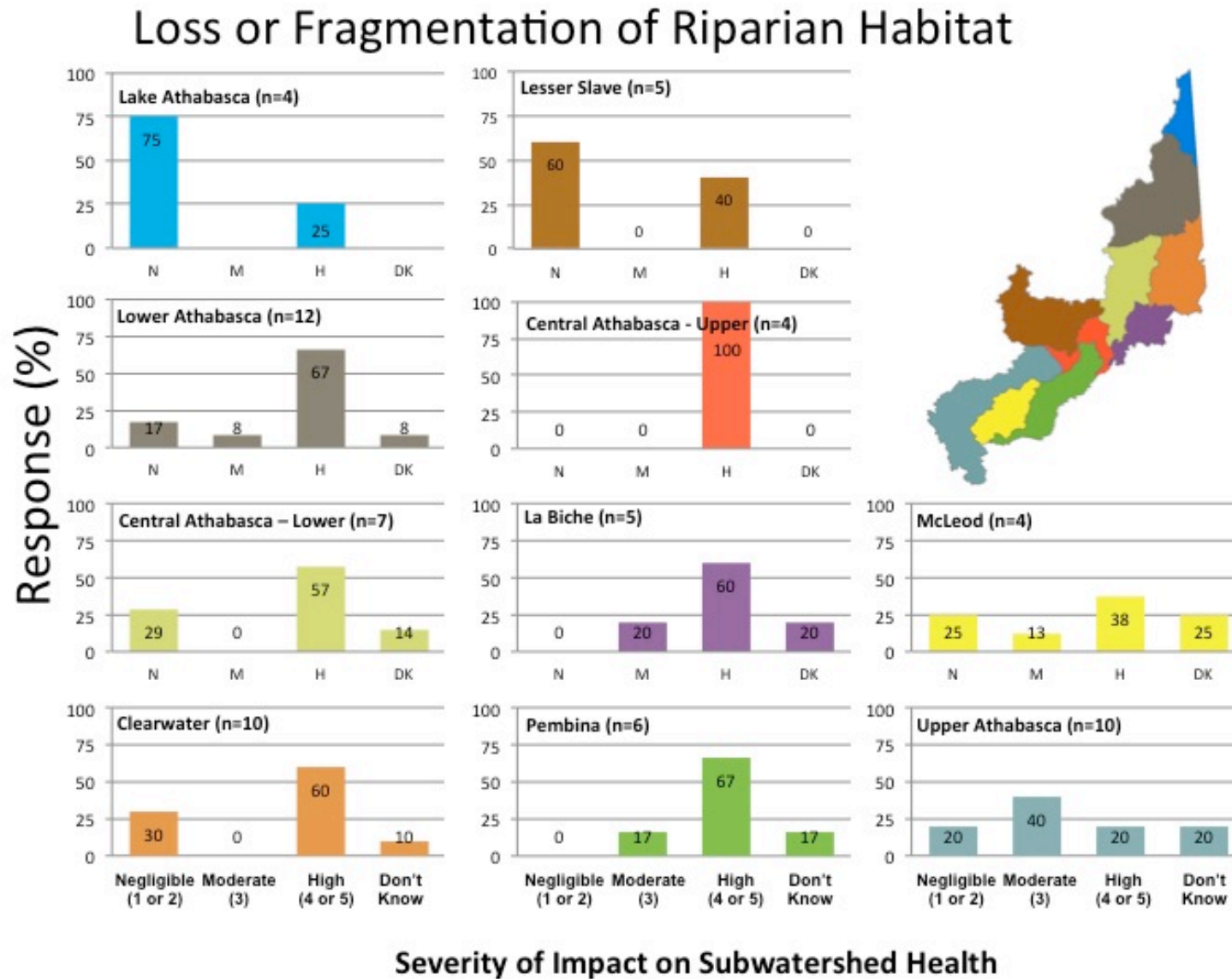


## Population Growth

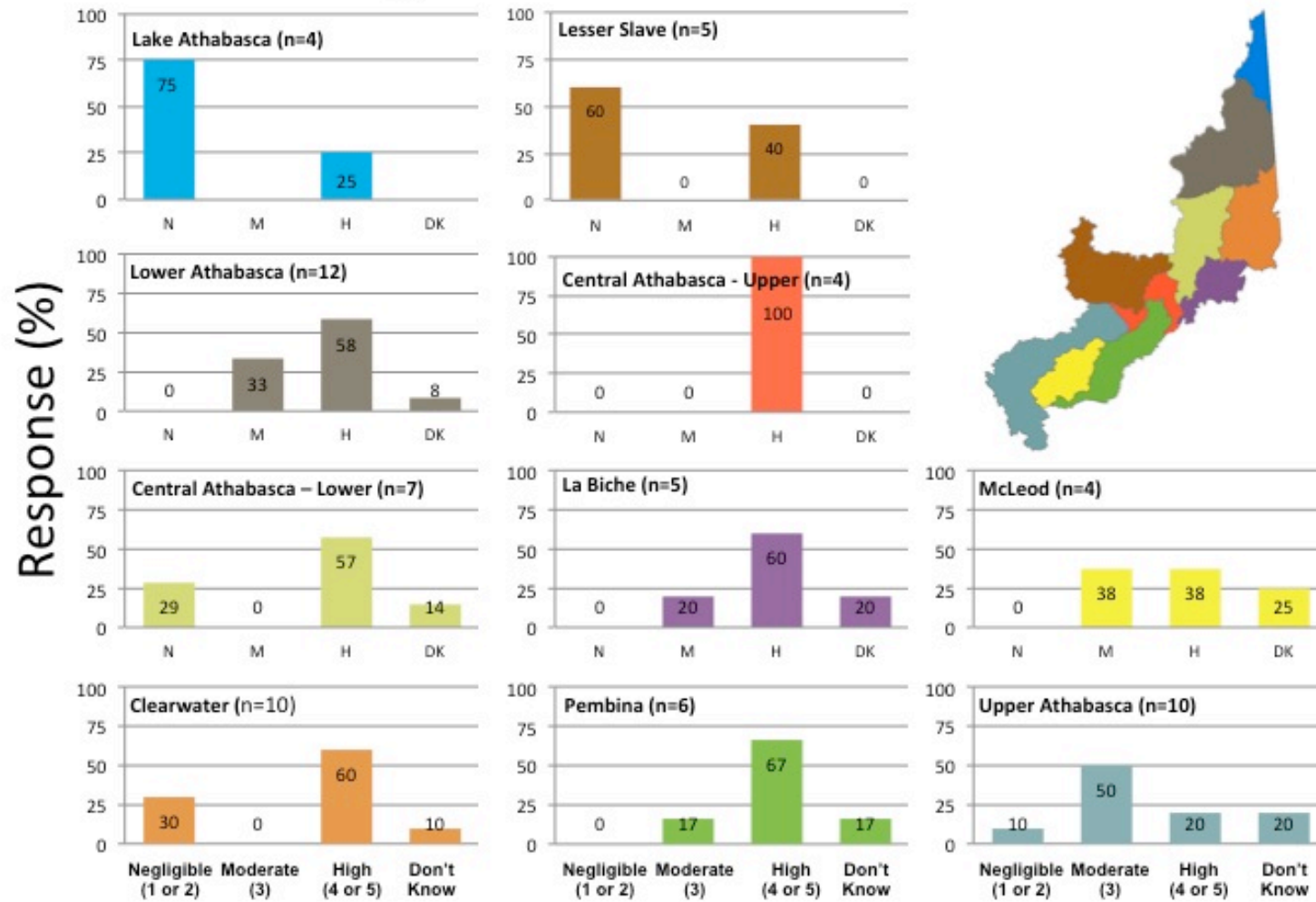


## Severity of Impact on Subwatershed Health





## Loss or Fragmentation of Stream Habitat

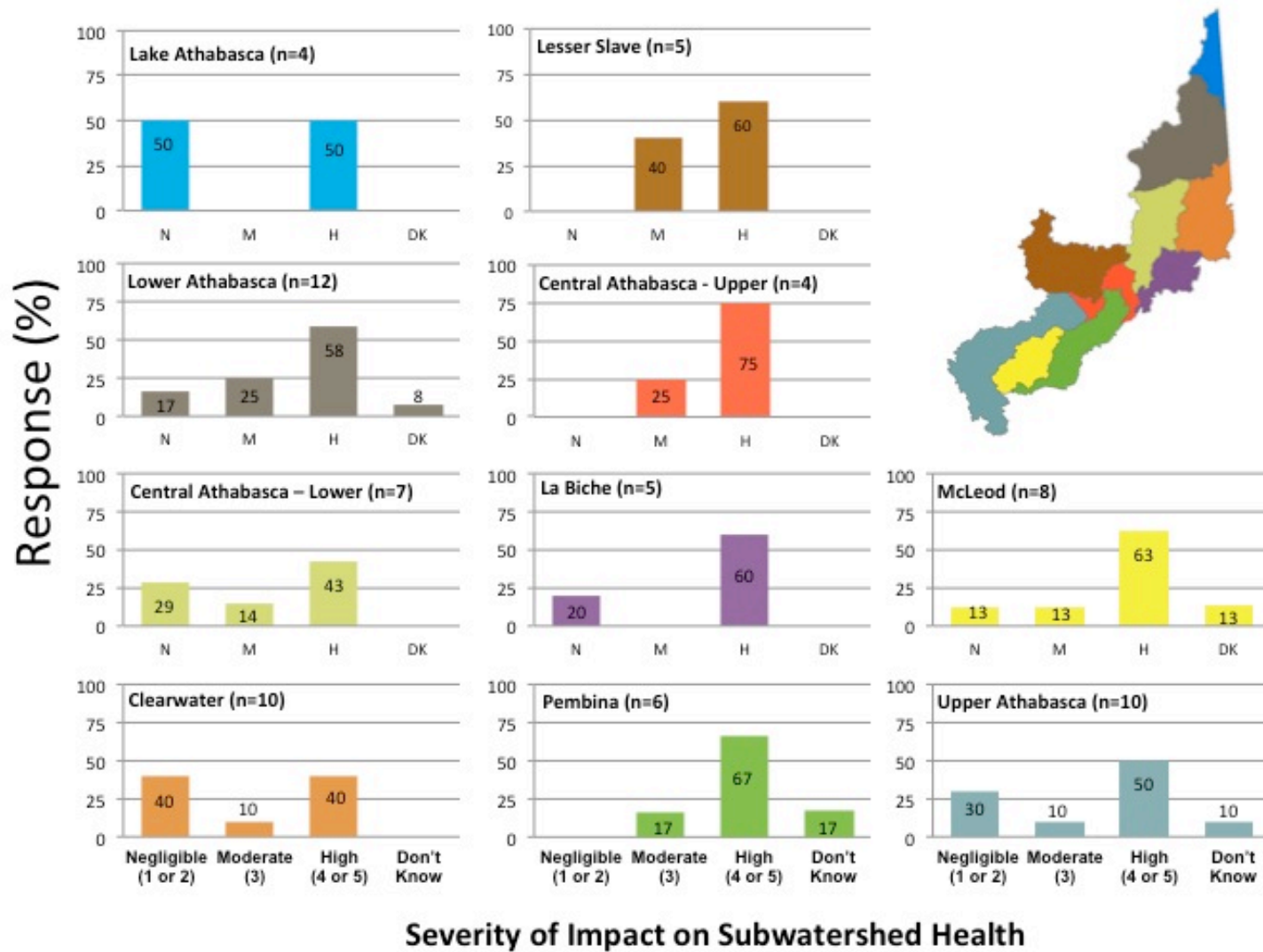


## Severity of Impact on Subwatershed Health

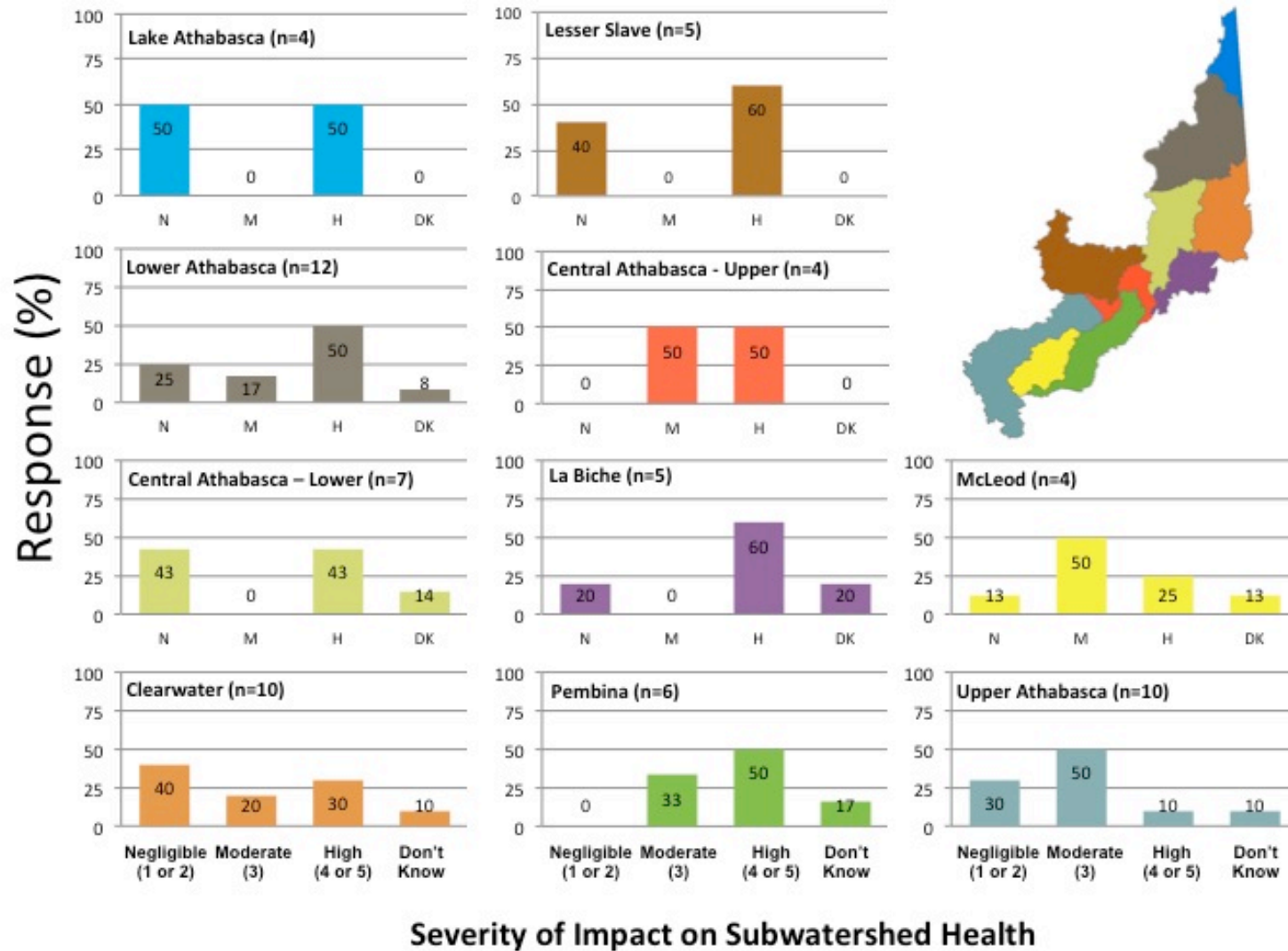




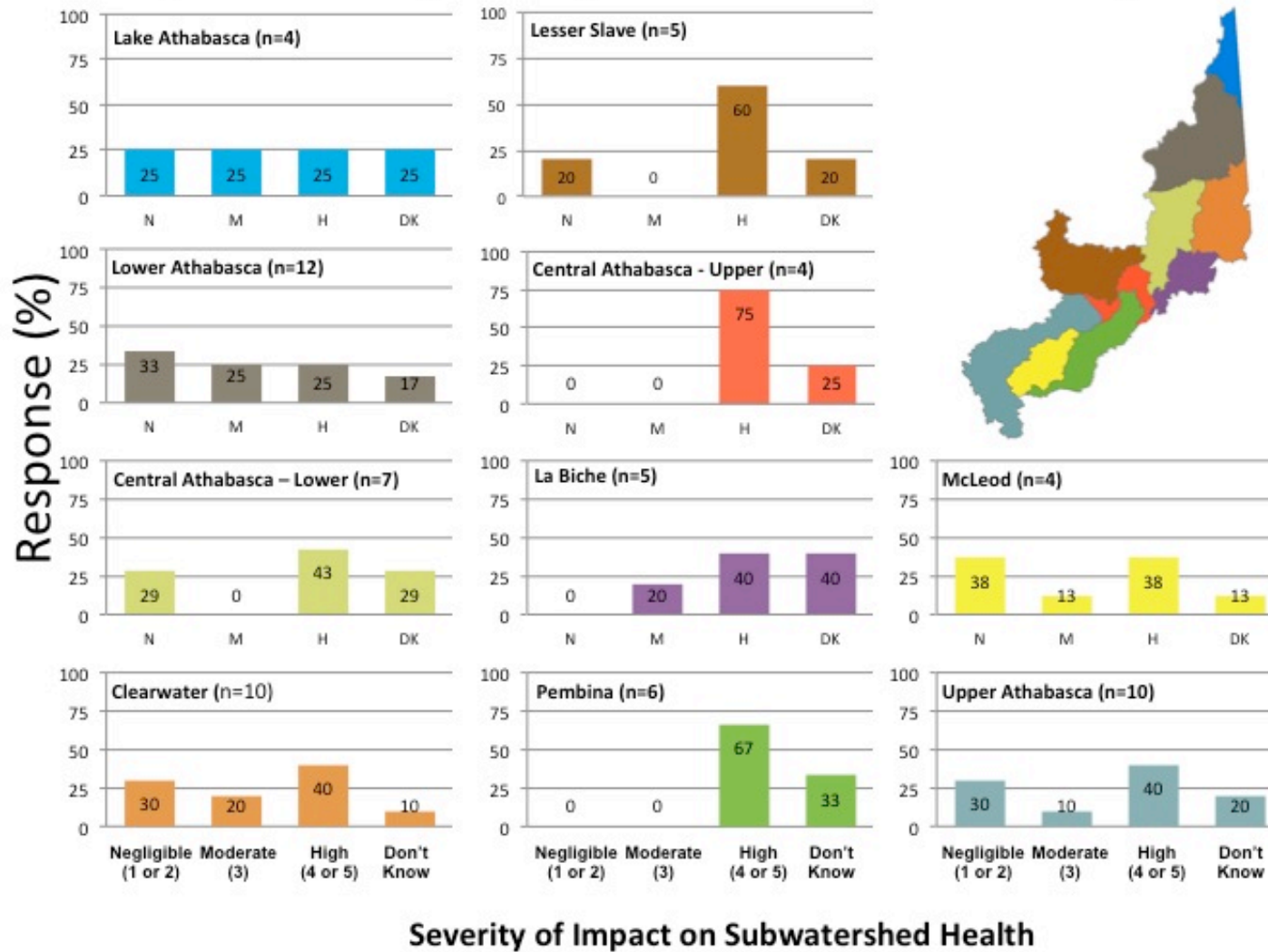
## Pollution or Nutrients from Point Sources



## Pollution or Nutrients from Land Runoff

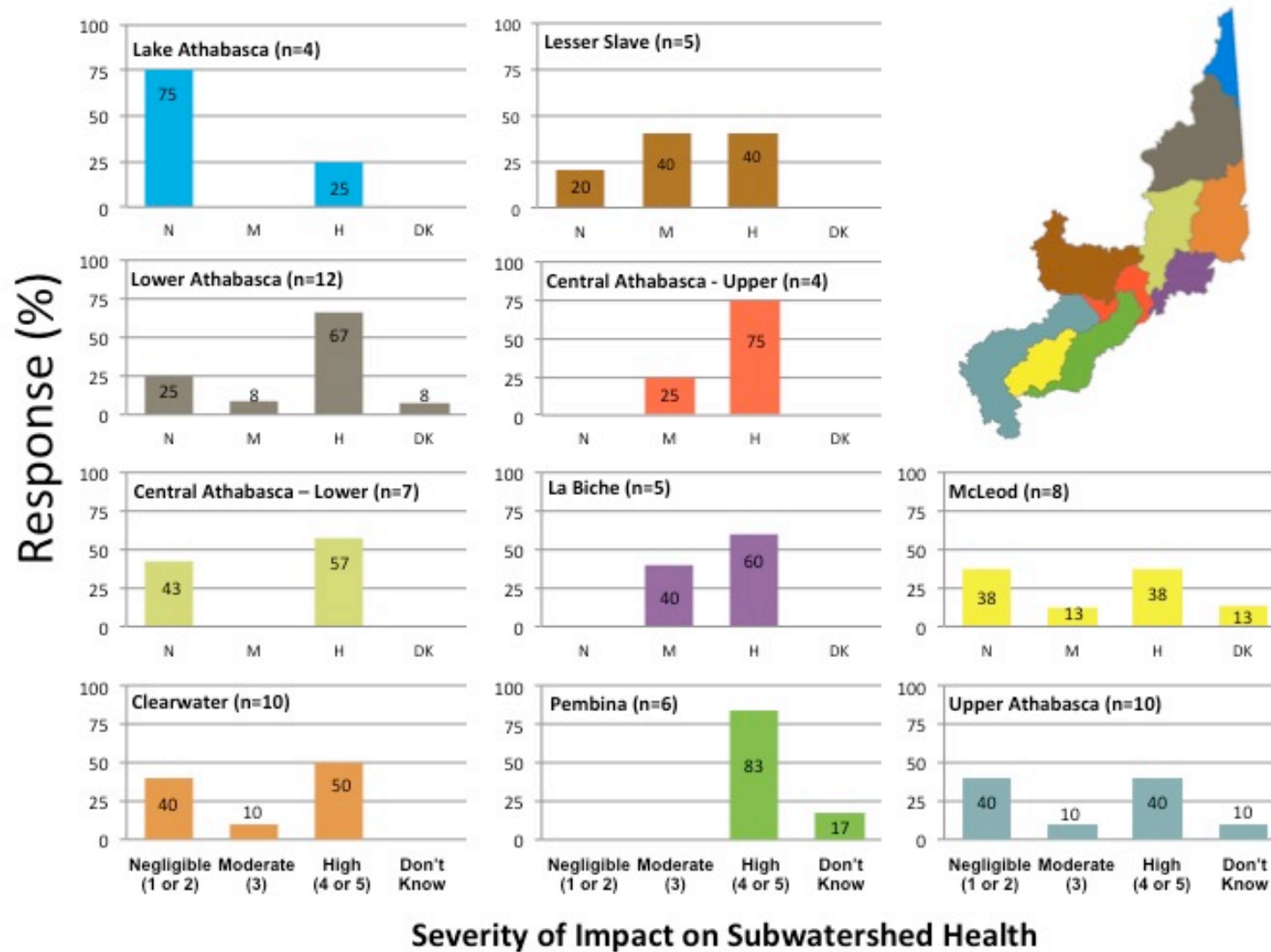


## Changes in Average Temperature or Annual Precipitation

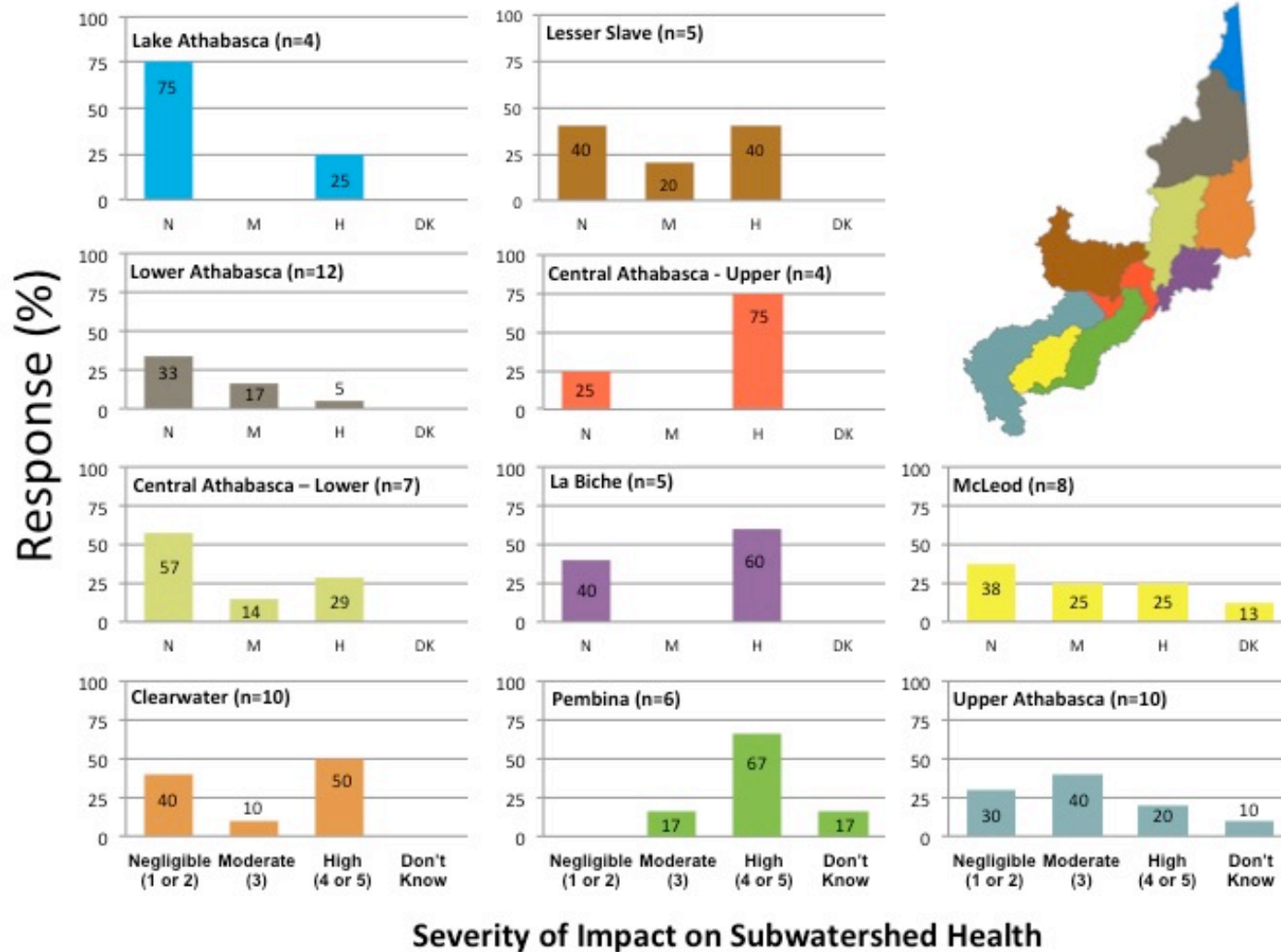




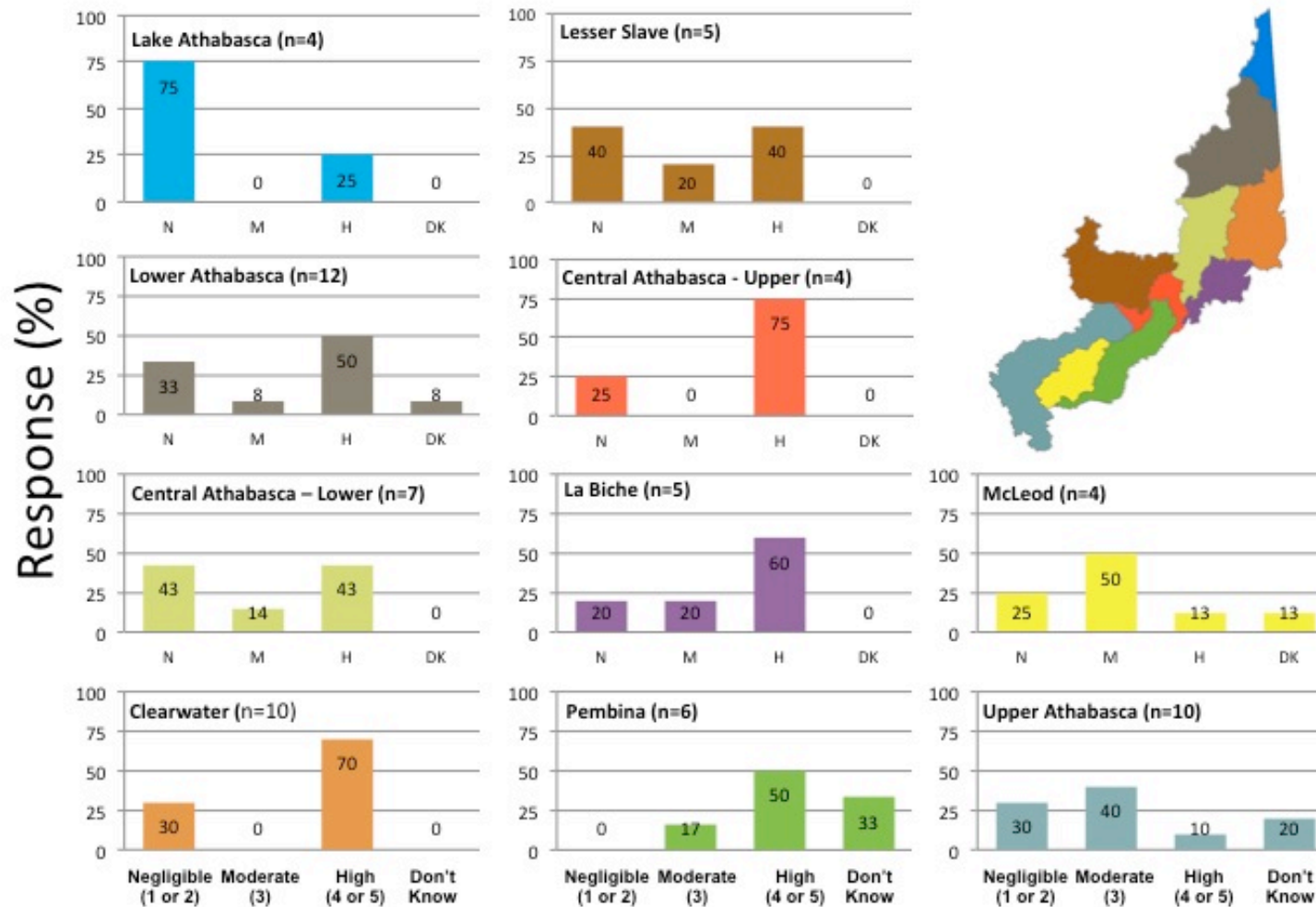
## Loss of Wetlands



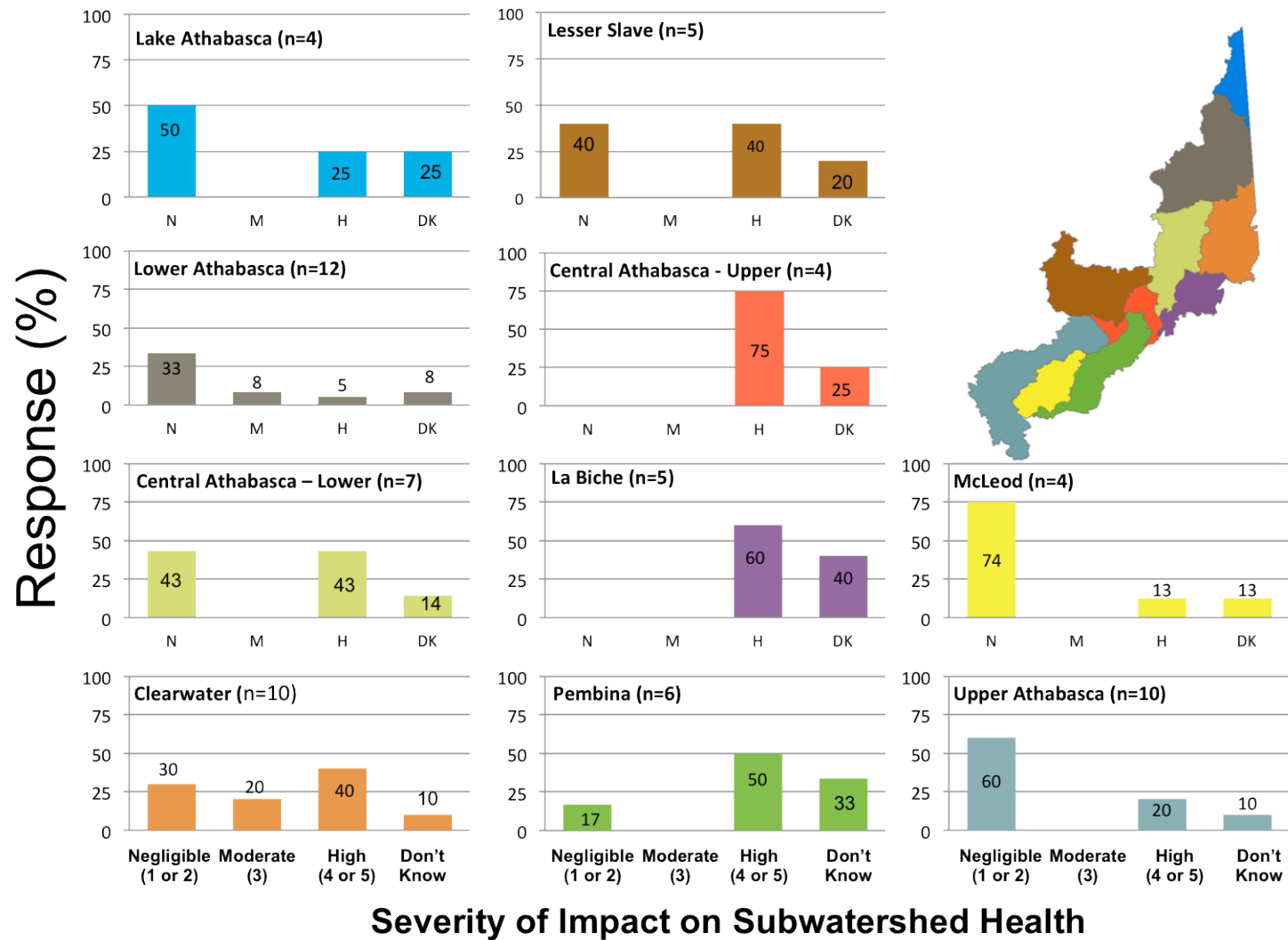
## Diversion and Use of Surface Water



## Withdrawal and Use of Groundwater



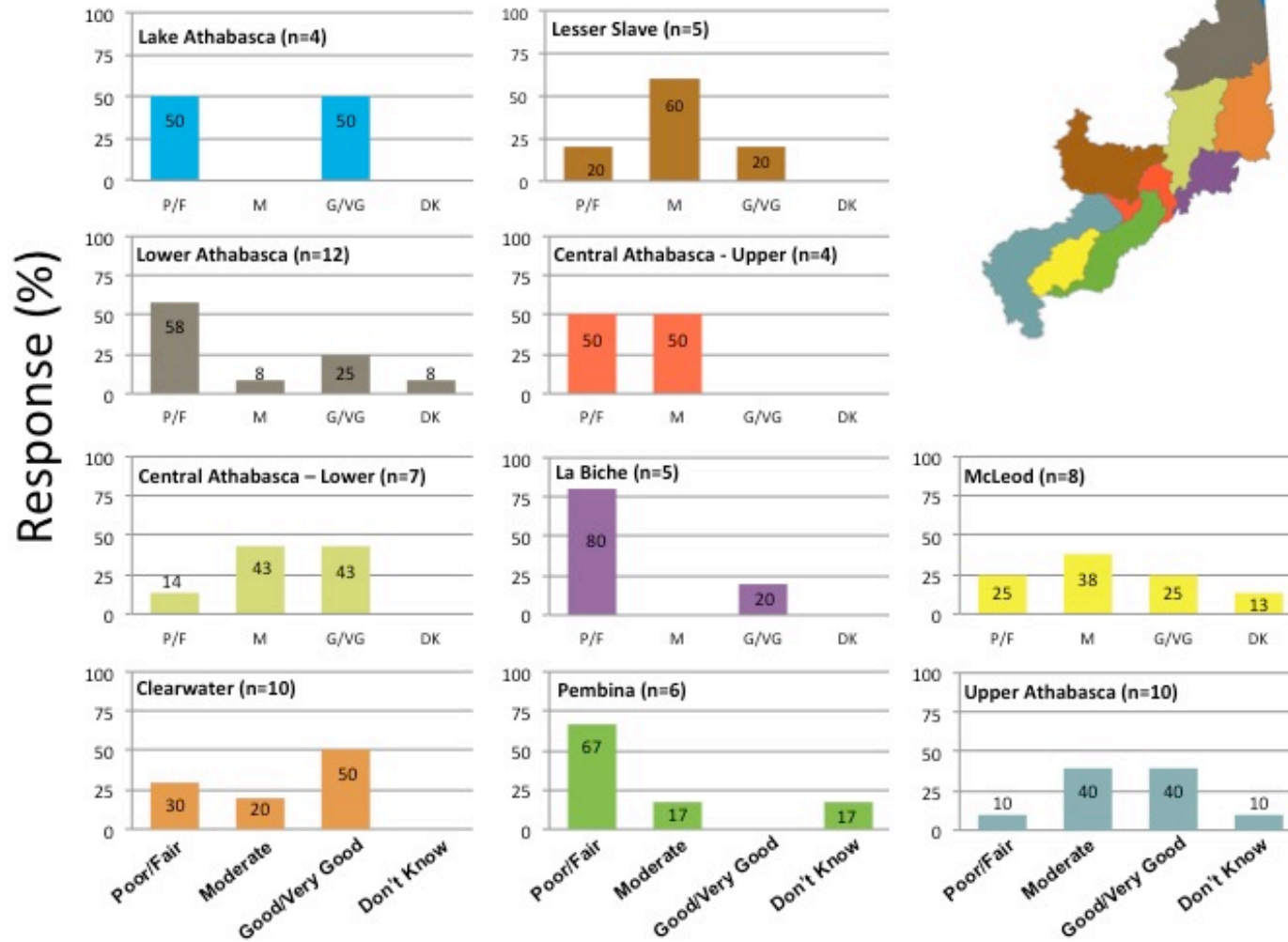
## Acidification of Lakes



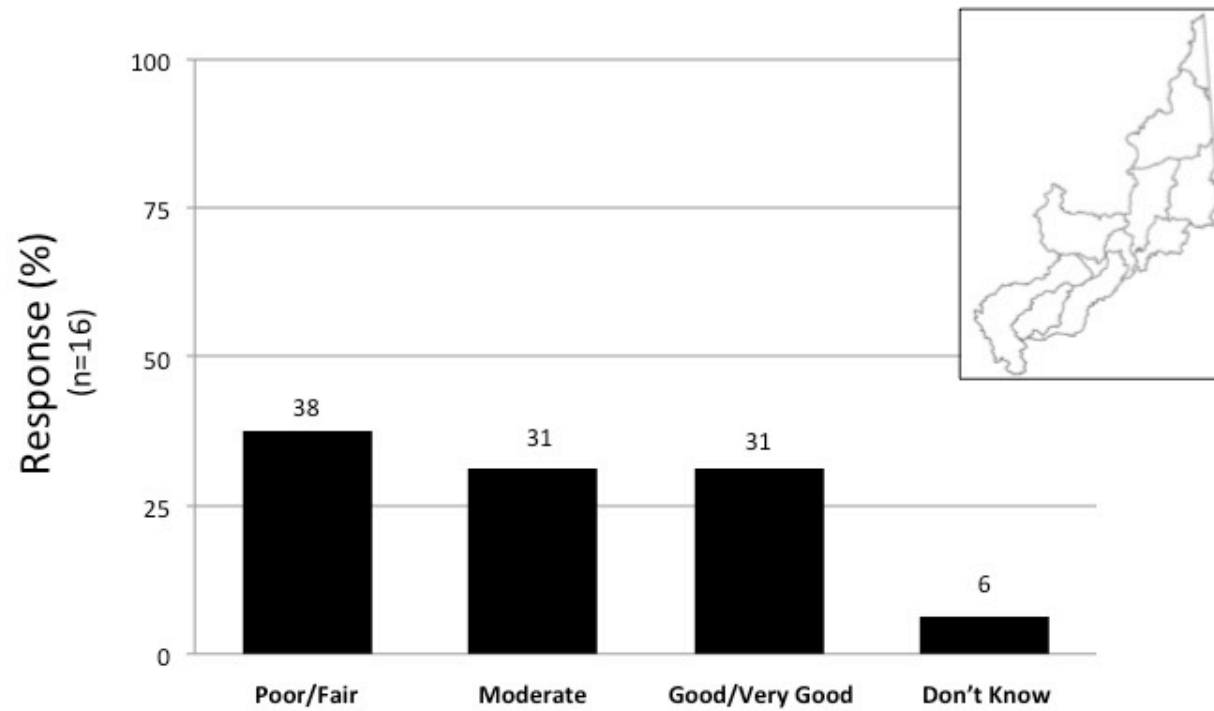
## **Appendix C: Current Health Figures**



## Current Health



## Current Health – Athabasca Watershed



## **Appendix D: Open-ended Responses**





#### Question 4.1

What do you see as the most significant challenge to maintaining (or improving) watershed health in the Athabasca Watershed?

##### ABORIGINAL

- Managing impacts of development; it is important that we correct or reverse any and all impacts to the watershed.
- Industrial activity in the Oil sands region, reclamation of tailing ponds and managing population growth.

##### NGO

- Limiting the withdrawal of non-saline groundwater and the withdrawal of water from the Athabasca River and tributaries for bitumen production, as well as the loss of wetlands, which reduces groundwater recharge.
- EDUCATE MUNICIPAL GOVERNMENTS, IF POSSIBLE !!! IMPLEMENT EFFECTIVE PROVINCIAL REGULATION OF AGGREGATE MINING !!! IMPLEMENT EFFECTIVE MONITORING OF SURFACE WATER AND GROUNDWATER !!! IMPLEMENT EFFECTIVE IMPACT ASSESSMENT AND CUMULATIVE EFFECTS MANAGEMENT !!! IMPLEMENT EFFECTIVE PUBLIC CONSULTATION FOR LAND USE DECISIONS !!!
- Industrial water withdrawals.
- Overly permissive approach to energy leasing, exploration and development which is completely unsustainable in slow growing, sensitive boreal landscape also under pressure from climate change. Unsustainable forestry allowable cuts in slow-growing boreal landscape also under pressure from climate change. Undervaluing of peat wetlands that are degraded by many developments, and destroyed by others - once destroyed, cannot be replaced. Peat wetlands are crucial to water security, connecting surface and groundwater in boreal landscape where evapotranspiration exceeds precipitation - as well as crucial to biodiversity. Unsustainable gravel mining of alluvial aquifers.
- Industrial activity effects on watershed.
- Proliferation of thermal mining of the oil sands in the Athabasca, Peace and Beaver watersheds. Vegetation removal, by all methods, leading to runoff of soil and contaminants.

##### GOVERNMENT

- I am not an expert in this field, but my personal opinion would be that the government needs to have tighter regulations for water use for Oil & Gas activities (i.e. limiting the amount of water being used as well as what they do with the water that is contaminated). Also more care should be taken for natural resource activities which have an effect on our watershed.
- The planned continued expansion of oil sands development, both in the mining and in situ areas. This will completely alter landforms in the mining areas, severely disrupt ecosystems in the in situ areas and potentially compromise downstream eco system



health. Another factor will be the unknown effects of warming over the 21st century. All other factors pale next to these.

- Acquiring the support and interest from everyone in the area- this is required to make a sufficient change in the watershed.
- Appropriate industry regulations and public support / awareness.
- The most significant challenge will be to reduce the negatives impacts to surface water. These include the impacts of sedimentation, water quality, flow regimes and water use. Oil and particularly gas developments that depend on fracing have the potential to use significantly serious quantities of surface water, and to pollute ground water aquifers. How we use water, what we do to it, and how we affect the water cycle is the fundamental issue.
- Development along the watershed including ATV usage.
- How to effectively apply resource conservation strategies throughout the watershed. The relationship between technical issues and policies issues, the collaboration between all the institutions, industry and stakeholders.

#### INDUSTRY

- Coordinated approach between all industry sectors and government. Too many silos and independent actions going on - only way to address cumulative effects is for everyone to work together.
- Agricultural nutrient discharge, industrial and municipal volumetric use and quality of discharges.
- "Pollution" or other inputs like agricultural run-off, municipal sewage treatment discharge (numerous chem compounds and potential nutrient addition), fishery management, water withdrawals and base flow protection. low risk concern but should include - damming or control structures on the river
- Managing source environmental impacts to realize the cumulative potential impacts and to ensure regulations and monitoring are aimed at understanding and managing any changes that may be occurring on both an individual source and cumulative basis.

#### OTHER

- Industry control of political decisions and failure of politicians to provide a level playing field for industry (regulate, monitor and prosecute) and protection of sustainability of renewable resources. Everyone knows the 'sustainable development' mantra but has forgotten the original caveat about not impairing productivity for future generations. Current industrial economic prosperity is ignoring the long-term environmental costs that future generations will require for a healthy watershed & prosperous economy.
- Managing the tar sands development so that we don't destroy the Mackenzie Basin with poisoned groundwater flow or acid rain or a catastrophic spill from a tailings pond. We must keep in mind the centuries-long potential for these things as a result of the current tar sands technology and the rush to exploit the sands without proper knowledge of the long-term effects.



- The continuing failure of federal and provincial governments to either provide or support transparent, scientifically legitimate environmental monitoring and assessment programs that are designed to detect significant changes in ecosystem health, distinguish between anthropogenic and natural causes of change, and determine in-stream flow needs for rivers, sustainable yields for groundwater aquifers, and other critical environmental thresholds. Although, the lack of legal foundation for WPACs and watershed planning under the Water For Life strategy are arguably the biggest challenge, when viewed in the context of the Regulatory Enhancement Project being pursued coincidentally by the Alberta Government. The REP will take legal precedent over land use planning and decision-making, because it has the legal framework that provides its authority.
- Consult with First Nations.
- Governments blind commitment to unnecessarily fast exploitation of Tar sands, other oil and gas deposits and forests. Government greed is supported by ecologically illiterate voters...

**Question 4.2:**

In your opinion, what is (are) the most important management change(s) that needs to be made in the next several years to ensure the long-term health of the Athabasca Watershed?

**ABORIGINAL**

- We need better monitoring by an independent group, not industry self monitoring; we need better management to correct what the monitoring results are; if there are changes to the environment what are we doing to correct those changes; what is in place to protect the river?
- Impartial monitoring of the Environment (air, water and Wildlife)

**NGO**

- Implement a wetlands policy. Improve groundwater monitoring across the basin to provide baseline data against which to measure future changes - in order to prevent unsustainable withdrawals.
- EDUCATE MUNICIPAL GOVERNMENTS, IF POSSIBLE !!! IMPLEMENT EFFECTIVE PROVINCIAL REGULATION OF AGGREGATE MINING !!! IMPLEMENT EFFECTIVE MONITORING OF SURFACE WATER AND GROUNDWATER !!! IMPLEMENT EFFECTIVE IMPACT ASSESSMENT AND CUMULATIVE EFFECTS MANAGEMENT !!! IMPLEMENT EFFECTIVE PUBLIC CONSULTATION FOR LAND USE DECISIONS !!!
- No Surface water withdrawal for in-situ mining. Ground water monitoring for quality/ quantity and recharge rates. Surface water and ground water interaction, should be understood before issuing water withdrawals.
- A wetlands policy that values boreal peat wetlands and places strong emphasis on avoiding and minimizing disturbance to them. A biodiversity management framework with linear disturbance thresholds to sustain old-growth and intact-forest dependent species (in line with our international commitments to conserve biodiversity), within which industry must operate. Implementation of surface and ground water withdrawal



and quality management frameworks with thresholds for healthy aquatic ecosystems, accompanied by better surface and groundwater monitoring of surface and ground water quantity and quality.

- Tighter restrictions on water use within this watershed by industry.
- Some government will/leadership to curtail oil sands extraction to a manageable level. I think it is prudent to extend oil sand recovery over a long period rather than a short period; wealth now for a few versus wealth for many over many generations.

#### GOVERNMENT

- Regulating Oil & Gas activities.
- Continuous improvement in the environmental monitoring systems for the oil sands, significant reductions in tailing pond volumes, clear guidelines on land reclamation especially for end pit lakes), implementation of the Phase 2 water management framework recommendation, identification of an upper limit of annual bitumen production
- Make it mandatory that representatives from surrounding municipalities have a position on the watershed council.
- High regulatory standards, enforcement and long term monitoring
- The self-regulatory strategies adopted by the Prov. Govt. aren't making the grade because the most important component (auditing and prosecution) are inadequate. Codes of Practice, EAPs, Best Management, etc., no matter how comprehensive, are a mute point if there is no political will to support compliance. There is a fair bit of lip-service given to this issue, but it needs actual regulatory support & prosecution of violators. 'Environmental Health provides social benefits and economic health', not the reverse concept as promoted by several of the major industries in the upper watershed.
- Limit access for off road ATV and keep buffer a minimum 1 km along river on both sides
- New policies should reflect the technical or scientific findings of the state of the watershed.
- Coordinated partnership approach. Must address water withdrawal issue as non-conventional energy sector water use increases. number 2 is fixing old stream crossings - again must work together to scope scale of problem and fix.

#### INDUSTRY

- Point source quality improvements, agricultural management programs to reduce nutrient discharge, implement water use criteria (withdraw minus discharge) to reduce downhole disposal
- Ecological base flow establishment and protection control of municipal and industrial point source discharges as well as non-discrete agricultural sources including specific limits and concentration developing a world class monitoring program that provides a high level of confidence that the right things are being measured at the right time to help us as a province make the right decisions



- A consistent and meaningful management and monitoring approach to truly understand potential impacts. A streamlined regulatory/approval approach may also help to properly manage potential cumulative impacts.

#### OTHER

- Change in government to shake up the lobbyists in global industry and get politicians looking after the long term prosperity of a broader spectrum of Albertans. Need effective regulations/enforcement to deal with cumulative impacts of fragmentation, canopy loss, climate change and other destruction that is death by a thousand cuts and no single perpetrator is responsible but the results are already apparent. Must stop petroleum and large industries from running roughshod over renewable resources with decisions made by politicians that ignore responsible science. Aggressive public relations and advertising have replaced scientific based decisions.
- Slow tar sands growth so we can manage the impacts. This is not being done at this time.
- The regulatory processes, procedures, and decision-making standards in environment impact assessment hearings for major industrial project proposals need to be legitimized, including the demand that EIAs themselves be performed in a way that reflects accepted scientific standards of legitimacy rather than simply industry standards that are related to satisfying the requirements associated with regulatory approvals and environmental permitting. Regulatory and license approvals that in law are conditional upon meeting the requirement of not resulting in environmental harm must not be given where there is either significant harm or risk thereof.
- Involve First Nations
- Put ecosystem health and clean waters ahead of greed, gov't royalties, jobs and 'economic growth. Water and Land need to be seen as Sacred Gifts NOT just resources to be exploited. GOA and GCan need to learn and apply the 'precautionary principle'..

#### Question 4.3:

Do you have any final thoughts or comments that you would like to share?

#### ABORIGINAL

- Protecting the environment and water should be the utmost importance to government not industrial development; we need to start thinking of the water as a spirit that needs to be respected
- Now is the time for World class monitoring that is transparent for peer review

#### NGO

- Cumulative impacts of watershed units is necessary relative to landcover change and water flow
- I think that it would be much better for Albertans and Canadians to insist that a percentage, say 50%, of Alberta's crude oil be refined in the country rather than having the highly skilled refinery jobs exported to the United States or China. This requires governmental action rather than industrial action.



## GOVERNMENT

- Although a lot of effort has been given to develop this survey, I have some concerns with the responses that you may receive. Unless you are very knowledgeable in the subject, I feel that there will be many respondents that may only provide their opinion, which may or may not be accurate. This will have a great effect on the outcome of your results.
- Four decades of applying regulatory strategies, or modifying them to support the maintenance or recovery of environmental health has not worked well at the landscape level. Numerous species in the upper Athabasca are in serious decline or threatened, all because of the cumulative effects of various land uses. A very serious look at what is driving this needs to happen - I'm not sure we'll like the answer.

## INDUSTRY

- The Athabasca is a unique river in this province and needs to be afforded the appropriate consideration for all of its features. I believe that one central WPAC will be challenged to provide this given its length, different concerns in each section, site specific considerations, and tough decisions that need to be made. It will be good to know how the WPAC will interface with the "regional plan" and in particular the Lower Athabasca Regional Plan(LARP)
- There has been a lot of good work completed in the Athabasca Watershed however there really does need to be some consistency so that data can be comparable and better used to inform future management frameworks and track potential changes over time. We need to build on what is already been done or adapt things to make it more useable for everyone.

## OTHER

- Albertans are well aware of the terrible waste & extirpation of bison by early settlers but seem to ignore the current and continuing loss of major species such as caribou and grizzlies, bull trout, Athabasca rainbow trout, pygmy whitefish and Arctic grayling in the Athabasca drainage and in other drainages Westslope cutthroat, lake sturgeon, and many prairie species. The decline of these species is a strong indicator of declining watershed health and will not recover until ecological diversity and healthy habitat is restored. Coal mining, fracking, shale gas, dams and riparian gravel operations will be the next source of short term prosperity and serious environmental degradation. (How about adding spell-check to these boxes(:>))
- At this time Alberta doesn't appear to care about the downstream effects on NWT and the Mackenzie River because they are out of Alberta's boundaries. This makes me ashamed to be an Albertan.
- Albertans need to have an adult conversation about long-term watershed planning, what their priorities are, what their long-term goals are, what attributes they want reflected in their watersheds, rivers, and lakes, and what they are willing to forego in economic development in order to ensure those things. Until the Government of Alberta stops pretending that everyone can do whatever they want, whenever and wherever they want to do it, we will continue further down the path of unsustainability.
- Involve First Nations

