E. Data Gaps and Omissions

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1. Data Gaps

The data gaps summarized here are often related to the limitations described after the results for each CA, CE, or MQ in the previous chapters. The summary below is intended to provide comprehensive documentation of all data gaps encountered throughout the REA process for the YKL study area. Data gaps are organized by CA and then CE.

1.1. Data Gaps Related to Climate and Cliomes

Core REA Analysis

Uncertainty relating to climate modeling, climate data, and the cliomes model are described in detail in the appropriate sections of the Technical Supplement. This uncertainty led to some limitations in the scale at which results could be analyzed and the conclusions that could be drawn from the data. In addition to the constraints imposed by these inherent uncertainties and limitations, there were also constraints to this analysis imposed by gaps for which no climate data was available. These gaps are summarized below.

- SNAP temperature data refers to air temperature only. Although spot data for water temperature from specific sites and locations are available, no systematic, consistent, complete, or gridded data are available. This limits the applicability of SNAP data to aquatic assessments.
- Although many of the weather phenomena that affect CEs are linked more closely to extreme events than to average conditions, no consistent gridded climate data were available at a temporal scale finer than the monthly data available from SNAP. Lack of daily data makes it difficult to project events such as extreme heat, extreme cold, flash floods, and rain-on-snow events.
- The available precipitation data do not differentiate between rain and snow; nor is any direct metric available for snow pack depth, rain on snow events, or other parameters that directly or indirectly impact certain CEs. However, we were able to add snow day fraction to the climate-related datasets in order to partially meet this need.
- Data used for day of freeze, day of thaw, and season length are estimates, since precise direct data and models for these variables are not available. Modeled estimates do not correspond to metrics of freeze and thaw for particular water bodies or soils. Varied lag times apply.
- All climate models and data are based upon the best available information, but these models have themselves been created from limited datasets. Long-term climate stations are extremely sparse in general in Alaska, and very few of these stations are located above 500 m elevation.
- Climate data, while relatively fine-scale, are not available at 30 m resolution.
- Available climate data do not always match, in scale or detail, the climate-related attributes and indicators most closely linked to particular fine or coarse CEs.
- Even when linkages between CEs and climate variables are relatively clear, in many cases, the literature does not provide precise information regarding threshold values.
- Percentage-based relationships between cliomes and land cover classes can be appropriately viewed only as estimates.
- Time lags can be expected between changes in climate and associated changes in vegetation, but there is little data on the duration of these lags.
- The cliomes model does not take into account the projected increase in fire on the landscape.

- The cliomes model is linked only to climate, and not to physiographic features that also determine habitats and ecosystems.

Omitted Management Questions

The following MQs were originally proposed for inclusion in the YKL REA but were omitted for various reasons and include some element of data limitations or uncertainties (see Section 2. Omitted Management Questions for full list of omitted MQs):

What are the likely impacts of changing freeze-up and break-up on transportation and community access?

- Data on freeze-up and break-up were general and extrapolated rather than specific to particular water bodies, transportation routes, and communities.
- The literature offered little quantitative data linking changes in freeze-up and break-up to transportation and community access in the REA region.

How will climate change affect glacially dominated watersheds and non-glacial systems?

- Spatial data were not available differentiating between these two types of watersheds.
- Quantitative climate data on direct impacts to glaciers were not available.

Where will climate change events impact subsistence species?

- Given that climate data were not available at daily resolution, little could be said about "climate change events" as opposed to more general climate change trends.

What is the current frequency (by location) of icing events in the REA?

- Data indicating the frequency of icing events are not available.
- Snow day fraction datasets are provided instead as an approximation of the probability of a snow-on-rain event.

Could changes in climate impact current or future timber harvests?

- We cannot predict the impact on timber harvests because we lack data to predict changes in future demand or need.
- Reliable species-specific and site-specific data on the relationship between climate and forest growth were not available. However, model results relating to fire frequency may be pertinent to this question.

1.2. Data Gaps Related to Permafrost

Core REA Analysis

The outputs of permafrost modeling and mapping are imperfect, despite being based on the best available data layers. Uncertainty is present at multiple levels, stemming from the inherent uncertainties of climate modeling (discussed in the applicable section of this report) and the uncertainty associated with linking climate to soil thermal dynamics.

- Clear data describing the feedbacks between permafrost thaw and vegetation change does not exist.
- Threshold dynamics are complicated by feedback between fire, vegetation, and climate, and no data or models fully track these feedbacks.
- Permafrost can thaw very rapidly following fire, especially if the organic layer is consumed, but stochastic models cannot predict the exact timing, location, or intensity of fires.
- The best available permafrost model provides outputs at 1 km resolution. Discontinuous permafrost can vary at scales much finer than this, due to variable slope and aspect, drainage patterns, etc.

Omitted Management Questions

How might changes in permafrost impact water quality for human consumption?

- Data on soil thermal dynamics existed at a broad scale, not at the level of individual water sources associated with particular communities.
- Individual results of thawing events vary widely and could not be predicted with the required degree of specificity.

How might changes in permafrost impact resource development?

- There was no way to address this in a meaningful manner spatially because it is more dependent on economic feasibility than changes in permafrost.

How might changes in permafrost impact lake drying?

- Permafrost data were not at a fine enough scale to precisely predict lake-specific changes.
- Additional information on drainage would be necessary to predict lake drying. However, changes in drainage at a broad scale were discussed, with lake drying as a potential change.

How might changes in permafrost impact designated wetlands?

- Permafrost data were not at a fine enough scale to precisely predict wetland-specific changes.
- Additional information on drainage would be necessary to predict wetland drying, movement, or increases. However, changes in drainage at a broad scale were discussed, with loss or changes to wetlands as a potential change.

How will changes in permafrost change current erosion patterns?

- While erosion along river banks is likely to increase due to loss of permafrost, no explicit data exists with which to model this change.

1.3. Data Gaps Related to Fire

Core REA Analysis

As noted above, ALFRESCO is not suited to fine-scale analysis at either a temporal or spatial level, due to the stochastic nature of its outputs. Thus, interpretation must be considered more broadly, in terms of trends over time, rather than in terms of specific fire behavior at particular sites.

- No clear and consistent data are available regarding fire severity.
- No consistent data are available on changes in lightning strikes or other fire starts over time.
- Fire is highly variable over space and time, and thus can only be modeling stochastically; the precise timing and location of future fires cannot be predicted.
- Because the ALFRESCO model is not directly linked to either the climate/vegetation (cliomes) model or the permafrost model used in this assessment, feedback between vegetation, fire, and soil thermal dynamics could be considered only qualitatively, not quantitatively.
- Difficulties in calibrating the ALFRESCO model to the strict standards insisted upon by the SNAP modeling team meant that model outputs were limited to forested areas, and did not include potential tundra fires.

Omitted Management Questions

Where might future fires occur in relationship to future wildlife habitat?

- No existing fire model is this spatially precise – and all future fire models are likely to also be stochastic. The ALFRESCO model offers estimates of percentages of some habitat types that may burn, but not precise timing or location.

What was the historic lightning strike frequency and pattern in the ecoregion?

- AFS has this data, but the data are not consistently accurate over time.
- As detection gets better and better, more strikes are recorded. Thus, any derived correlation between fire frequency and lightning strikes is likely to be misleading.

What is the historic data for burn severity in the ecoregion?

- These data are inconsistent, and thus difficult to use in modeling.

1.4. Data Gaps Related to Invasive Species

Core REA Analysis

Uncertainty related to infestation vulnerability modeling, invasive species and forest pest data are described in detail in the appropriate sections of the Technical Supplement. These uncertainties led to limitations in the scale at which results are meaningful and what conclusions could be drawn. These primary gaps are summarized below.

- Survey data for invasive species is lacking for many regions and concentrated in and adjacent to population centers. Therefore current distributions of non-native species are likely to represent a subset of the total area. Interpretations of current and future infestation vulnerabilities are likely to inflate the importance of roads and population centers.
- Future infestation vulnerabilities are based on development scenarios and climate change models that are inherently uncertain – caution should be exercised in interpretation of these outputs.
- Interactions among disturbances, climate change, and human activities are likely to be very important in invasive species establishment; however we have limited understanding of these indirect effects.
- Research specifically directed towards movements of invasive species in rural Alaska is very limited.

- Research on ecological impacts of invasive species on species and habitats of conservation concern are largely absent in Alaska.

Omitted Management Questions

Which abiotic factors explain the most variation in habitat suitability for highly invasive species present in the REA or likely to occur in the REA?

- Factors associated with the presence of invasive species are outside the scope of the REA and the AMT desires to reduce the number of invasive species questions. Environmental layers explaining variation in habitat suitability, however, is a common output of predictive modeling approaches and is imbedded in the results.

How are the abiotic factors that explain the most variation in habitat suitability for highly invasive species likely to change over time?

- Essential elements of this question were integrated into MQ #26.

What effects on subsistence species populations would the introduction of wood bison have?

- AMT and UA Team agreed that this is not a high priority question.

1.5. Data Gaps Related to Insects and Disease

The majority of the study area (54%) has not been surveyed in the past 15 years for insect and disease damage, and much of the study area has likely never been surveyed. While the aerial forest damage surveys approximate trends in insect and disease pests for the entire study area, much of the study area lacks data.

Management Question

The following data gaps are related to the aerial forest damage survey datasets available from USDA Forest Service State and Private Forestry for years 1989 to 2013:

- Forest damage survey for the entire study area (only 46% of the study area has been surveyed in the past 15 years and many areas have not ever been surveyed).
- Flight paths for aerial damage surveys conducted from 1989-1998 are not available.
- Large subset of damaged area lacks identified insect or disease agent or host type.
- Data related to severity is absent or provided in qualitative descriptions instead of in quantitative format such as estimated percent mortality.

Omitted Management Questions

Which areas are most susceptible to infestation by pest defoliating insects and bark beetles?

How are areas susceptible to pest defoliating insects and bark beetles likely to change over time?

Modeling insect or disease agent outbreak susceptibilities would need to be species-specific because of species-specific risk factors and life history. Furthermore, insect outbreaks are stochastic in nature and any model would

at best be able to produce only vulnerability areas. Data related to the following points currently are non-existent or lack adequate detail and would be required for modeling susceptibility of insect and disease agents:

- Information related to timing: start time, duration, and decline of infestation. Because infestations are not revisited annually, there is little spatial data that captures temporal patterns for each insect and disease agent.
- Migration of insect and disease agents and distance of new establishment of infestations from parent infestations.

1.6. Data Gaps Related to Anthropogenic Change Agents

Core REA Analysis

Uncertainty in the extent and nature of the human footprint is evident in the YKL.

- Local roads are not well identified in the AK DOT dataset.

Omitted Management Questions

How are declining fish and wildlife populations restricting sport hunting and fishing?

- This is a regulatory question and cannot be addressed within the scope of the REA. .

How have general regulations affected general harvest species?

- Estimating the relationship between harvest regulations and species populations is impractical, because there are many other factors involved.

Is there unreported subsistence take, and if so what is the estimated amount?

- Most subsistence harvest reporting is not mandatory.

Are non-subsistence activities (transporters/tourists/sport hunters/sport fishermen) affecting subsistence harvests or access?

- This cannot be addressed with the available data. Subsistence harvest data is not available for all communities for all years. Without continuous data series, it is impossible to address this question.

How could subsistence harvests (species, amounts, and seasons) change in the future?

- Data on subsistence harvests is available through Alaska Department of Fish and Game. Data is collected through sample surveys, annually, at a community level. However, due to lack of resources, only some communities are surveyed each year. Some communities are not surveyed for several years in a row. Imputing these values is impossible due to the large amounts of missing data. A projection of subsistence harvests is impossible with so much data missing.

How could changes in the hunting industry impact recreational levels?

- Data on recreation in the region is minimal. This question cannot be addressed with available data from the few parks and preserves in the region. However, those refuges are working on improving their data collection so may be able to be addressed in the future.

How is commercial harvest of salmon likely to change in the future?

- Given that most of the commercial harvest of salmon occurs offshore, this question was considered out of scope. Additionally, salmon population decline is a huge question, likely affected by climate change and change in ocean habitat and by-catch that are topics outside the scope of an REA.

Where are current timber harvests?

- This question was partially addressed in Section B, but is largely considered a data gap. Timber harvest in the region is minimal, and the industry has been declining over the last two decades. With the advent of biomass projects across the region, there is potential for higher harvests, but these operations are small-scale community projects and are not expected to utilize large amounts of wood.

What forestry products (biomass) are available now?

- Data is unavailable at the ecoregional scale, and is thus considered a data gap.

How might accessibility of forestry products (biomass) to communities change in the future?

- No reliable inventory of forest products is available for this region. Timber operations were partially addressed in the report in Section B. Access to Donlin Creek and a planned road between Yukon and Kuskokwim rivers at their closest point are the only likely new transportation routes in the near future. These will certainly improve access to the forest products, albeit for very few communities. Donlin access road will be high traffic industrial-use road, just 13 miles long, and is not likely to improve access to forest products for any community.

How might timber harvest change in the future?

- With limited timber harvest data, it is impossible to project changes in the future.

What is the expected life cycle for the Donlin mine? Startup-peak-end.

- This question cannot be answered since production and lifecycle depends not only on the availability of the mineral, but also on feasibility of extracting it in light of the market conditions, all of which are beyond the scope of this project. However, the projected lifecycle, according to newsletters from the mining company, is 25 years.

What is the current status and impacts, if any, from military lands and what is forecast?

- This question was not answered since the military lands are small in the region, and cannot be addressed at an ecoregional level.

What is the seasonal round in each community (for which there is a study/data)?

- This question was not addressed because it involved exploring and analyzing traditional ecological knowledge (TEK). It was decided early in the project that all TEK-related questions will be left unanswered in favor of an overarching question about the extent and status of recorded TEK in the region. This was addressed in the report.

1.7. Data Gaps Related to Erosion

Although there is no portion of the REA directly devoted to erosion, the BLM originally proposed a single erosion MQ.

Omitted Management Question

Where are high erosion areas located within the ecoregion currently?

- Detailed data on erosion is unavailable, as is any biophysical setting or physiographic regions information. The only data available is if a community is at risk of erosion, which was noted in Section B.

1.8. Data Gaps Related to Conservation Elements

Data gaps related to specific CEs or groups of CEs are described in sections 1.9 through 1.13 below. The data gaps listed in this section correspond to omitted MQs that apply broadly to all CEs.

Omitted Management Questions

Which plant and animal species of conservation concern (present on federal or state conservation lists, e.g., Threatened – USFWS, Sensitive Species - BLM) may be impacted by highly invasive species?

- The effort required to address this question would have been substantial, so the AMT recommended removing it and instead using the products from the core analysis to help address this question.

How much development is reasonable to maintain functional and intact ecosystems?

- Part of this question is addressed in Section C (Landscape and Ecological Integrity), but the answer ultimately comes down to a value judgment. There is no single metric of ecosystem functionality, so measurement and identification of reasonable thresholds is not available. Thus, the answer can change depending upon the functions of an ecosystem that are most important to a given set of managers. Likewise, there is no single definition of an intact ecosystem, and even the term “intact” is a value judgment that is very hard to universally define and quantify.

1.9. Data Gaps Related to Terrestrial Coarse-Filter Conservation Elements

Existing vegetation map not comprehensive and too (ecologically) coarse.

- Currently the best data we have is a mosaicked vegetation map using an aggregation of several different mapping projects.

- We need a seamless vegetation map for the region that has high enough resolution to pick out ecologically meaningful CEs using a consistent classification system, imagery, processing steps, and accuracy assessment.

Inadequate soil survey or ecotype map for the region.

- Existing soil surveys are too coarse or are not available for the entire project area.
- These would be helpful to predict vegetation response to disturbance and climate change.
- These maps would also provide information on permafrost and soil ground ice.

Need vegetation succession map (Biophysical Setting, or Ecological Site).

- Currently we have existing vegetation maps which do not take in account succession.
- These are necessary to understand how vegetation responds spatially to disturbance and climate change.

Lack understanding of rates of vegetation succession and climate change.

- Data is limited for most terrestrial coarse-filter CEs in understanding how vegetation communities might respond to disturbance and climate.

1.10. Data Gaps Related to Terrestrial Fine-Filter Conservation Elements

- A suitable snow-depth layer for the YKL study area would allow for better interpretation and prediction of forage/browse accessibility and winter movements for moose, caribou, and musk ox.
- Finer scale climate data, including daily temperatures and precipitation, may provide more insight into severe storm events which affect survivability, reproductive success and prey abundance and/or availability for many bird species in the region (e.g. peregrine falcon, trumpeter swan, olive-sided flycatcher).
- Finer resolution of land cover classes (i.e. separating willow and alder classes from tall shrub) would improve the winter browse model for moose. More accurate imagery would be necessary for this task.
- Empirical data are needed to develop accurate caribou distribution models (as opposed to known range maps). These data are available through the Alaska Department of Fish and Game but a data sharing agreement was not feasible within the timeframe of this REA.
- Caribou radio collar data are needed to identify and delineate accurate migration corridors. These data would also improve the accuracy of distribution models and range maps.
- Musk ox survey data available for the Nulato Hills area from the Alaska Department of Fish and Game would increase the accuracy of the distribution model in the YKL area. A data sharing agreement was not feasible within the time frame of this REA.
- Long-term beaver population density data would allow for assessment of changes over time in relation to relevant change agents (i.e. mean temperature).
- Detailed monitoring of peregrine falcon populations in areas other than the Kuskokwim and Yukon River basins would provide a better overall assessment of peregrine falcons in the YKL region and allow for population assessments over time in relation to relevant change agents.

Omitted Management Questions

Where might breakup and/or precipitation based floods (frequency, duration, magnitude, water levels) impact winter moose habitat?

- This question was considered a data gap given the lack of a hydrologic model for the region. Additionally, events like breakup occur at a finer temporal scale than global climate models can predict, limited the ability to predict specific weather events.

Where are key movement corridors?

- This question was ultimately omitted due to data gaps. Data sharing agreements were proposed to obtain information for caribou (the only CE with enough data to infer movement corridors), but were not successful within the time of the assessment.

What is the minimum size for "unfragmented" habitats?

- This question is partially answered in Section C (Landscape and Ecological Integrity), but largely depends on the species or value of concern. Overall intactness is defined in Section C, but determining a minimum size is beyond the scope of this REA.

What effects on subsistence species populations would the introduction of wood bison have?

- This question was omitted after substantial discussion with the AMT. It was ultimately determined that the answer would be too speculative to be useful and was therefore omitted from our assessment.

How might permafrost-driven waterfowl habitats change in the future?

- This question is partially addressed in Section D through the aquatic coarse-filter CE assessment. However, without a good dataset depicting permafrost-driven waterfowl habitats, we labeled this MQ as a data gap and was thus omitted.

1.11. Data Gaps Related to Aquatic Coarse-Filter Conservation Elements

- No existing habitat classification map.
- The National Hydrography Dataset (NHD) is very outdated (most topographic maps were created in the 50's and 60's) and stream locations and lake areas have likely changed due to natural hydrologic disturbances and climate change.
- Similar to the NHD, The Digital Elevation Model (DEM) for the YKL region was produced by digitizing topographic maps produced in the 1950s from aerial photography (the DEM from the National Elevation Dataset for all of Alaska was produced by digitizing topo maps), thus the source of the dataset is often of poor accuracy. The 60 m resolution of the DEM in the study area is far below standard compared to the data available for the rest of the United States. The low resolution further increases the disparity between the NHD flowlines and the flowlines generated from the DEM.
- Small streams are underrepresented because they are often masked by vegetation cover and not visible on aerial photography.

- Both stream order and stream gradient are needed to map aquatic habitats; the NHD is not attributed with stream order and does not align with valley bottoms in the Digital Elevation Model (DEM) so stream gradient cannot be calculated accurately.
- Water temperature data and climate change predictions specific to aquatic habitats are lacking.

1.12. Data Gaps Related to Aquatic Fine-Filter Conservation Elements

The following data gaps related to all Aquatic Fine-Filter CEs fall primarily into two categories: climate dependent changes in aquatic habitats and population dynamics.

- Water temperature data for the YKL study area is lacking.
- Climate-linked aquatic models to predict future changes in water temperature.
- *Icthyopyhonus* spp. infection rates as a function of increased temperature (specific to Chinook salmon).
- Data related to effects of permafrost thaw and increased winter precipitation on spawning, rearing, and overwintering habitat.
- Data related to long-term trends and temporal changes in fish populations.
- Data related to impacts of subsistence and commercial fishing on salmon populations.
- Very little is known about sheefish spawning habitat in the region.

2. Omitted Management Questions

Because the REA is rapid, the BLM has mandated that only 30-50 MQs be addressed through an REA. The original list of suggested MQs was too numerous for the BLM target, and covered topics well outside the scope of an REA. In order to reduce this list to a workable number, the UA Team refined the list by:

1. Removing questions that were considered "out of scope" for this REA because:
    a. They were at an inappropriate scale (i.e. asked site specific questions)
    b. They asked specific policy questions
    c. They were methodological questions
    d. They were non-terrestrial
    e. They required new data to be collected
    f. They were too theoretical (i.e. ecological theory)
    g. They were not appropriate for the timeframe of the REA
2. Ranking questions (High, Medium, Low) based on:
    a. Effort required to address the question
    b. Whether the question fit into an REA-type analysis
    c. Whether products developed would be useful to managers

However, to ensure transparency in the REA process, we include those original questions as well as the justification for not addressing the MQ (Table E-1).

Table E-1. MQs omitted by the AMT with a justification.

Vegetation Communities
Where is lichen habitat in the region? **Justification:** This lichen habitat question is redundant; another MQ that addressed primary winter caribou forage is addressed in Section D.
How might lichen habitat change in response to change agents? **Justification:** This lichen habitat question is redundant; another MQ that addressed primary winter caribou forage is addressed in Section D.
Where are key sensitive area/core habitat areas? **Justification:** This is redundant with multiple Terrestrial Fine-Filter CE MQs (Section D).
Where are the least ecologically sensitive areas? **Justification:** AMT members suggested removal of this question. Least ecologically sensitive is a subjective term that differs from species to species and habitat to habitat.
Where will the habitat for sensitive species be in the future? **Justification:** AMT members suggested removal of this question. Our predictive capacity is too poor for this to be useful.

Where might breakup and/or precipitation based floods (frequency, duration, magnitude, water levels) impact winter moose habitat?

Justification: Low support for this question from the AMT.

What are the primary lichen species that compose the lichen land cover classes in the region?

Justification: This MQ was omitted due to data limitations.

What is the distribution of ecological site descriptions throughout the region?

Justification: While this is interesting information, the NRCS maintains an active database of ecological site descriptions that can be accessed by any BLM staff that is interested in the information.

How do we maintain ecosystem integrity?

Justification: This question was labeled too broad and vague to be answered within the REA context. AMT supported this designation.

What is the tipping point for ecosystem integrity?

Justification: Tipping point is a highly subjective term, and too vague a term to be answered in this REA.

What are cascading effects of development resulting in fragmentation?

Justification: This is partially addressed through the LCM and so was not repeated as a specific MQ. This decision was supported by the AMT.

Wildlife

Where does musk ox habitat currently overlap with change agents (climate change, fire, development, invasive species, etc.)?

Justification: Since musk ox were considered a CE, this question was addressed through the core REA analysis of CE and CA overlaps. Thus, this was not considered a separate MQ.

How might key prey species distributions change in the future?

Justification: Prey distributions in the future were considered low priority by the AMT.

Are there specific landscape changes that might create barriers to migration pathways?

Justification: The AMT ranked this as a low priority and was therefore removed.

What is the historical distribution of the Mulchatna caribou herd? How does this compare to the current distribution?

Justification: The AMT ranked this as a low priority and was therefore removed.

What are the current densities of brown bears and black bears throughout the region?

Justification: The AMT ranked this as a low priority and was therefore removed.

What datasets and models could be used to determine where and when water temperatures will change in the future?

Justification: The AMT ranked this as a low priority and was therefore removed.

Would there be affects to hyporheic flow and spawning areas or wintering habitat?

Justification: This was considered out of scope and a data gap due to no hydrologic (or hydrogeologic) models for the region.

Have the increased number of weirs on the Kuskokwim River reduced the size of King Salmon runs?

Justification: This question was brought up at the Aniak community meeting. However, it was not identified as a priority question by AMT.

How might water chemistry change as a result of future CA (fire, development/mining, warming, etc.)?

Justification: Water chemistry data is lacking for the entire study area, so it was eliminated as a substantial data gap.

Abiotic Factors

How might changes in permafrost impact water quality for human consumption?

Justification: Low AMT support.

How might changes in permafrost impact resource development?

Justification: Low AMT support.

How might changes in permafrost impact lake drying?

Justification: Low AMT support.

How might changes in permafrost impact designated wetlands?

Justification: Low AMT support.

How will changes in permafrost change current erosion patterns?

Justification: Low AMT support.

What are the likely impacts of changing freeze-up and break-up on transportation and community access?

Justification: Low AMT support.

What are the likely impacts of changing surface water hydrology on water resources?

Justification: Low AMT support.

How will climate change affect glacially dominated watersheds and non-glacial systems?

Justification: Low AMT support.

Where are high erosion areas located within the ecoregion currently?

Justification: Low AMT support.

How will climate change affect the distribution of invasive species (plants and insects)?

Justification: This was considered as part of the core analysis and therefore was not included as an MQ.

Where will climate change events impact subsistence species?

Justification: This pertains to single specific events, which are unpredictable.

What is the current frequency (by location) of icing events in the REA?

Justification: Low AMT support.

How might climate change affect the frequency and location of icing events in the REA?

Justification: Low AMT support.

Could changes in climate impact current or future timber harvests?

Justification: This was ultimately removed at the request of the AMT since it would require substantial effort beyond the scope of the REA.

Where might future fires occur in relationship to future wildlife habitat?

Justification: Deleted and combined with hydrology questions following AMT comments.

Are wildlife and smoke impacts to communities likely to increase in response to climate change?

Justification: Low AMT support.

What wildfire and smoke risks have historically been experienced by communities?

Justification: Low AMT support.

What was the historic lightning strike frequency and pattern in the ecoregion?

Justification: The AMT suggested we re-evaluate this question, potentially looking at a 10 year historical time period. AFS has this data, but the data are not consistently accurate over time. As detection gets better and better, more strikes are recorded. Thus, any derived correlation between fire frequency and lightning strikes is likely to be misleading.

What is the historic data for burn severity in the ecoregion?

Justification: These data are inconsistent, and thus difficult to use in modeling.

Biotic Factors

Which plant and animal species of conservation concern (present on federal or state conservation lists, e.g., Threatened – USFWS, Sensitive Species - BLM) may be impacted by highly invasive species?

Justification: Data gaps make the question currently unanswerable.

Which abiotic factors explain the most variation in habitat suitability for highly invasive species present in the REA or likely to occur in the REA?

Justification: Respondent indicated that questions related to which factors are associated with the presence of invasive species is outside the scope of the REA. Assuming habitat/climate envelop modeling is used, environmental layers explaining variation in habitat suitability is a common output and can easily be included. The UA team, however, agrees with the general comment that there are too

many invasive species questions relative to the importance in the region and we therefore suggest that factors associated with suitability are included in products, but are not pulled out as separate management questions.

How are the abiotic factors that explain the most variation in habitat suitability for highly invasive species likely to change over time?

Justification: Future species habitat/climate envelop modeling requires the assumption of no change in parameters of species niche space. Current areas susceptible to invasion may be possible to address (although invasion susceptibility is highly species specific and exploration is possible with only a limited number of species). Future areas susceptible to invasion are acknowledged to be highly speculative (and species specific); however climate envelope modeling and relationship of invasion to development can be explored through scenarios analysis. We have reworded question 4 and reworked the invasive species in the future question.

Which areas are most susceptible to infestation by pest defoliating insects and bark beetles?

Justification: The UA team is dubious about modeling defoliating insect outbreak susceptibilities since factors would be species specific (and there are > 10 species of defoliators in the ecoregion). Additionally, insect outbreaks are highly stochastic, and we have little data to address.

Which factors explain the most variation in presence and absence of pest defoliating insect outbreaks?

Justification: The UA team is dubious about modeling defoliating insect outbreak susceptibilities since factors would be species specific (and there are > 10 species of defoliators in the ecoregion). Additionally, insect outbreaks are highly stochastic, and we have little data to address.

What effects on subsistence species populations would the introduction of wood bison have?

Justification: AMT and UA team agrees to omit this question.

How are areas susceptible to pest defoliating insects and bark beetles likely to change over time?

Justification: Again, the UA believes there is a problem of breadth: multiple species responding to different variables, as well as a problem of stochasticity.

Anthropogenic Factors

Where are culturally relevant sites located in the REA and are they likely to be disturbed by development?

Justification: Scale of cultural sites is too small. Low priority for AMT.

Where are culturally relevant sites in the region?

Justification: Scale of cultural sites is too small. Low priority for AMT.

What is the settlement history of communities in the ecoregion? (Mining settlement, original AK Native settlement, statehood, military, etc.)

Justification: Too broad, vague. Low priority for AMT.

How are declining fish and wildlife populations restricting sport hunting and fishing?

Justification: Too broad, out of scope. Many other factors affect sport hunting levels. Would take a long time to answer. Low priority for AMT.

How have general regulations affected general harvest species?

Justification: Of interest to AMT but out of scope. It would take a long time to estimate the relationship between harvest regulations and species populations, because there are many other factors involved.

Is there unreported subsistence take, and if so what is the estimated amount?

Justification: No data. Most subsistence harvest reporting is not mandatory.

Are non-subsistence activities (transporters/tourists/sport hunters/sport fishermen) affecting subsistence harvests or access?

Justification: Too broad, vague. Low priority for AMT.

How could subsistence harvests (species, amounts, and seasons) change in the future?

Justification: Too broad, as per AMT review and out of scope. Factors affecting this are beyond the region.

How could changes in the hunting industry impact recreational levels?

Justification: Low priority for AMT.

How is commercial harvest of salmon likely to change in the future?

Justification: Of interest to AMT but out of scope. Salmon population is a huge question, affected by climate change and change in ocean habitat and by-catch.

Where are current and recent mine sites?

Justification: Redundant with energy-related MQs addressed in Section B.

Where are areas of highest mineral potential?

Justification: Redundant with energy-related MQs addressed in Section B.

Where are alternative and renewable energy sites?

Justification: Redundant with energy-related MQs addressed in Section B.

Where are areas of potential for wind, hydro, biomass energy (and where do they overlap with communities)?

Justification: Redundant with energy-related MQs addressed in Section B.

Where will mines be located? Can we estimate the total footprint (including tailings and associated infrastructure)?

Justification: Redundant with energy-related MQs addressed in Section B.

What are documented impacts of mining in the region?

Justification: This question is largely addressed in Section B. This MQ was collected from a community

meeting in Aniak originally proposed as “How will increased mining activity and the associated influx of new citizens affect communities and their subsistence resources?”

Are current contaminated sites vulnerable to disturbance as a product of erosion in the future?

Justification: Scale of contaminated data sites too small (point data), with the exception of mercury contamination from Red Devil Mine (under Land Use).

How is the human footprint impacting the environment?

Justification: Low priority for AMT as it is addressed by the LCM in Section C.

How and where might newer development areas impact the environment?

Justification: Low priority for AMT as it is addressed by the LCM in Section C.