TACCIMO
Template for Assessing Climate Change Impacts and Management Options

TACCIMO Literature Report

Literature Report - Annotated Bibliography Format

Report Date: September 03, 2013

Content Selections

Animal Communities

Amphibians

R1: Northern

R2 & R4: Mountain West

How to cite the information containted within this report

Each source found within the TACICMO literature report should be cited individually. APA 6th edition formatted citations are given for each source. The use of TACCIMO may be recognized using the following acknowledgement:

"We acknowledge the Template for Assessing Climate Change Impacts and Management Options (TACCIMO) for its role in making available their database of climate change science. Support of this database is provided by the Eastern Forest Environmental Threat Assessment Center, USDA Forest Service."

Best available scientific information justification

Content in this Literature report is based on peer reviewed literature available and reviewed as of the date of this report. The inclusion of information in TACCIMO is performed following documented methods and criteria designed to ensure scientific credibility. This information reflects a comprehensive literature review process concentrating on focal resources within the geographic areas of interest.

Suggested next steps

TACCIMO provides information to support the initial phase of a more comprehensive and rigorous evaluation of climate change within a broader science assessment and decision support framework. Possible next steps include:

1. Highlighting key sources and excerpts
2. Reviewing primary sources where needed
3. Consulting with local experts
4. Summarizing excerpts within a broader context

More information can be found in the user guide. The section entitled Content Guidance provides a detailed explanation of the purpose, strengths, limitations, and intended applications of the provided information.

Where this document goes

The TACCIMO literature report may be appropriate as an appendix to the main document or may simply be included in the administrative record.

Brief content methods

Content in the Literature Reports is the product of a rigorous literature review process focused on cataloguing sources describing the effects of climate change on natural resources and adaptive management options to use in the face of climate change. Excerpts are selected from the body of the source papers to capture key points, focusing on the results and discussions sections and those results that are most pertinent to land managers and natural resource planners. Both primary effects (e.g., increasing temperatures and changing precipitation patterns) and secondary effects (e.g., impacts of high temperatures on biological communities) are considered. Guidelines and other background information are documented in the user guide. The section entitled Content Production System fully explains methods and criteria for the inclusion of content in TACCIMO.

Resource Area (Factor): Animal Communities

Amphibians

R1: Northern

Bruzgul, J. E., Long, W. & Hadly, E. A. (2012). Temporal response of the tiger salamander (Ambystoma tigrinum) to 3,000 years of climatic variation. BMC Ecology, 5, 1 – 7.doi:10.1186/1472-6785-5-7

"The periods of higher effective moisture may provide deeper, more permanent ponds that would offer greater protection from aerial predators, but we cannot conclude that such a sampling bias is the only factor affecting fossil abundance [of tiger salamander, Ambystoma tigrinum, in Yellowstone National Park]. The significant difference in BSI [body size index] between paedomorphic and terrestrial adults during interval C [which corresponds to the bulk of the Medieval Warm Period], along with the increase in abundance, is evidence for warm climatic conditions that allows indeterminate growth of a terrestrial ectotherm to continue. This agrees with expected changes in A. tigrinum populations during the warming based on modern studies [Schauble 2004, Mousseau 1997]."

"Our results [from examining fossils excavated from Lamar Cave, Yellowstone National Park, and looking for patterns of response to climate] also demonstrate that a population of [tiger salamanders, Ambystoma tigrinum] can show changes in average body size without changes in the percentage of different morphologies. In the oldest intervals, E and D, paedomorphs appear to have been smaller (based on BSI [body size index]) than in other intervals, while the percent paedomorphic remained relatively constant. This suggests a favorable terrestrial environment where metamorphosing individuals continue to grow following the transition from the aquatic environment. This terrestrial growth will be most facilitated by warm conditions and abundant food. The available climate records show these relatively long time periods as variable, with periods of high and low effective moisture [Meyer et al 1995, Gennett 1977, Whitlock 1993]."

"Warmer and drier climate scenarios as predicted for the Yellowstone region [EPA 1998] would likely create less permanent aquatic environments and select for populations [of tiger salamander, Ambystoma tigrinum] with primarily metamorphosing individuals, against the retention of paedomorphosis. This scenario would decrease the vertebrate biomass in the aquatic system as well as reduce the predatory pressure on aquatic Ambystoma food sources. Such changes to the ecological system could result in unexpected biological feedbacks. Also, higher percentages and rates of metamorphosis would increase gene flow between populations. This, combined with probable decreases in sizes of populations, has the potential to alter the overall genetic diversity in the meta-population over time, perhaps reducing the ability of the species to respond to further perturbation of the system."

Hossack, B. R., Lowe, W. H. & Corn, P. S. (2012). Rapid increases and time-lagged declines in amphibian occupancy after wildfire. Conservation Biology, 27(1), 219 – 228.

"Burn extent and severity distinctly affected the temporal and spatial patterns of amphibian occupancy. Wildfire was associated with increased occupancy of boreal toads [Anaxyrus boreas], depending on forest structure. Our results and those of other researchers that show other species respond positively to wildfire reinforce the importance of maintaining natural disturbance regimes to maintain diverse biological communities (Russell et al. 1999; Smucker et al. 2005). We also found strong evidence of time -lagged declines in occupancy of the long-toed salamander [Ambystoma macrodactylum] and spotted frog [Rana luteiventris], primarily in areas where >50% of the forest within 500 m of wetlands was severely burned. Only 30% of burned wetlands crossed this 50% threshold; thus, populations in areas that burned less severely could provide sources to recolonize wetlands where populations were extirpated. "

Wilson, A. G. & Larsen, J. H. (1998). Biogeographic analysis of the Coeur d'Alene salamander (Plethodon idahoensis). Northwest Science, 72 (2), 111 – 115.

"The minimum average annual precipitation associated with [Plethodon idahoensis, the Coeur d'Alene salamander] is 50 cm for a locality on the Clark Fork River, Montana (47°, 23', 23" N; 115°, 48', 32" W; 760 m elev.). The Columbia Plateau and drainages of the Salmon, Bitterroot, and Flathead Rivers receive less than this amount and circumscribe the salamander's U.S. distribution (Figure 1). Except along the southern extent of the species' occurrence these lowlands are also underlain by unconsolidated Quaternary deposits [which limit their distribution]. Unconsolidated deposits flanking the Selkirk Mountains are within the climatic ranges of the salamander and bound the northwestern limit of its distribution."

R2 & R4: Mountain West

Amburgey, S., Funk, W. C., Murphy, M. & Muths, E. (2012). Effects of hydroperiod duration on survival, developmental rate, and size at metamorphosis in boreal chorus frog tadpoles (Pseudacris maculata). (2012). Herpetologica, 68 (4), 456 – 467. DOI: http://dx.doi.org/10.1655/HERPETOLOGICA-D-11-00093

"Our results [from subjecting tadpoles of Boreal Chorus Frog, Pseudacris maculata, to simulated hydroperiods in the laboratory using individuals collected from ponds spanning a range of natural hydroperiods (Colorado Front Range, USA)] suggest that some species of amphibians may have highly variable rates of metamorphosis depending upon hydroperiod conditions in their native ponds. If the ability to respond plastically to hydroperiod reduction is limited in some species such as P. maculata, then the inability to respond plastically could cause high levels of tadpole mortality as hydroperiods decrease as climate changes. This could result in severe impacts upon populations and species across the landscape. In addition, if response to hydroperiod is as variable as is suggested by our results, then reactions to climate change may vary from population to population."

"Based on our findings on [Boreal Chorus Frog, Pseudacris maculata], tadpoles developing in ephemeral wetlands will be even more strongly impacted by climate change than those species that can plastically respond [shown by subjecting tadpoles to simulated hydroperiods in the laboratory using individuals collected from ponds spanning a range of natural hydroperiods (Colorado Front Range, USA)]. Climate change is expected to impact ephemeral ponds more severely (Matthews et al., inpress), thus increasing the risk of desiccation for individuals who already appear to develop more slowly than those from permanent ponds. If these plastic responses are limited or locally adapted, then a species' or population's survival will depend on the extent or direction of the climate change effects. By understanding the role of hydroperiod in tadpole development and survival, better predictions can be made as to the effects such shifts will have on populations. In addition, more realistic and biologically significant conservation and management plans can be developed and implemented. If a hydroperiod response varies between populations or species, then policies specific to each circumstance would be required rather than overall similar management plans."

McMenamin, S. K., Hadly, E. A. & Wright, C. K. (2008). Climatic change and wetland dessication cause amphibian decline in Yellowstone National Park. Proceedings of the National Academy of Sciences, 105 (44), 16988 – 16993.

"The loss of pond habitat has been catastrophic to Yellowstone [National Park in Wyoming] amphibian populations. All three of the most common native amphibians, Ambystoma tigrinum, Pseudacris triseriata, and Rana luteiventris, have suffered declines since the early 1990s. The number of salamander populations has fallen by nearly half, the number of spotted frog populations has declined by 68%, and the number of chorus frog populations is down by 75%. Ironically, Bufo boreas, the only native amphibian highlighted by the ICUN as distressed (''near-threatened'', International Union for the Conservation of Nature and Natural Resources 2007), is the only species for which we did not detect a decline"

"In addition to the deterioration and loss of pond habitats [in Yellowston National Park, Wyoming], changing hydroclimate within the intervening landscape (Fig. 3) may interfere with the terrestrial portions of amphibian life cycles. All 4 amphibians [the blotched tiger salamander (Ambystoma tigrinum melanostictum), the boreal chorus frog (Pseudacris triseriata maculata), the Colombia spotted frog (Rana luteiventris), and the boreal toad (Bufo boreas boreas)] have generation times of several years and spend substantial portions of their lives on land. The conditions between breeding grounds determine the frequency of migration, and the genetic relatedness between A. tigrinum subpopulations across northern Yellowstone is correlated with the conditions of the intervening landscape (Spear 2005). Current landscape trends may mediate increased terrestrial mortality and decreased migration and colonization."

"In Yellowstone [National Park, Wyoming], the local hydrological changes contributing to amphibian declines are not isolated or local events and are attributable to regional and global changes in climate (Barnett 2008), which are likely to continue, if not accelerate, in coming decades (IPCC 2007). We have shown that the kettle pond amphibians have been impacted by climate in Yellowstone, which cascades to other species in these communities. Amphibian predators, such as herons, coyotes, and birds of prey, will be directly influenced by amphibian decline, and other species will be negatively impacted by wetland loss. Climate-linked impacts to other species in the Yellowstone ecosystem are also becoming prevalent (Wilmers 2005, Schneider 2001, Romme and Turner 1991). "