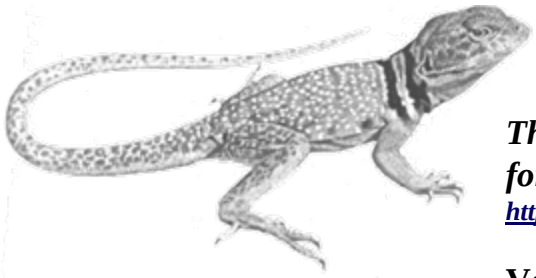

The Glade

The Newsletter of the Missouri Chapter of the Society for Conservation Biology

http://www.conbio.org/Chapters/Missouri/Index.cfm

Volume 10, Number 2 **Fall 2007**

Contents

News and Notes

•**MOSCB session at MNRC 2008!** MOSCB is sponsoring a session at the 2008 Missouri Natural Resources Conference on Climate Change and Missouri biodiversity. See the President's Column for details.

•**MOSCB Annual Meeting at MNRC 2008.** MOSCB will hold our annual meeting at the 2008 Missouri Natural Resources Conference. See the President's column for details.

•**MOSCB needs a Webmaster!** If you – or anyone you know – might be interested please let one of the Executive Board officers know. We are relocating the web site from the Mizzou system to the Society server and would like someone to supervise this transition and then maintain the site periodically.

•**The Glade is going electronic!** This will be the final mass printing of The Glade. The Executive Board decided at its spring meeting that moving to an electronic format was most consistent with the ideals of our organization, and would free up our limited funds for other outreach activities such as workshops. See the President's Column for details.

•**Are you moving?** Please let us know of any change in address so that we get your issue of *The Glade* to the right place! Email Stephanie Manka (SGManka@mizzou.edu) with address updates.

•**Contribute an article to *The Glade*!** We welcome article submissions from our membership for publication in *The Glade*. If you have a topic you would like to write about or read about, please email editor Todd Jones-Farrand (FarrandD@missouri.edu).

President's Column: Report and Plans

*Alan Journet, Southeast Missouri State University, Email: **ajournet@semo.edu***

2008 Missouri Natural Resources Conference Session

As previously announced in this column, we are organizing a workshop to be held during the 2008 Missouri Natural Resources Conference on the theme of "The Potential Consequences of Climate Change for Missouri's Biodiversity". We anticipate a half-day session on Friday. (Keep an eye on the conference website (http://www.mnrc.org/index.html) and the listserve for final details.) We are planning the event to run a little more along the lines of a workshop than in previous years, with an extended period inked into the schedule following coffee for a question/answer session and interactive discussion on the topic with the panel of speakers and possibly others.

The basic content of the workshop will be as follows:
Following a brief introduction, Missouri State Climatologist Patrick Guinan will talk about what climate models predict for Missouri. This will set the scene for the talks that follow since all speakers are being provided a summary of the model's predictions. After this – sequence yet to be determined – we plan to have presentations on the impact of climate change on: Missouri ecological associations, birds, herps, non-woody flora, insects, and a discussion of the implications of climate change for the Missouri Comprehensive Wildlife Strategy and endangered species and habitats. Each of these presentations will be relatively short, allowing maximum time for discussion.

The Silent Auction

Following our successful fund-raising event last year, we plan to re-run the Silent Auction, and plead with members to contribute something of value to this event. Please contact Nadia Navarrete –Tindall [NavarreteN@missouri.edu] with your ideas and contributions.

From Listserve to GoogleGroup

We have been engaged in ongoing discussions regarding the best method of providing our members the means to communicate with one another, and providing us with a mechanism to communicate – essential at election time. The University of Missouri- based list serve is being discontinued, and a GoogleGroup has been formed. To join the GoogleGroup, go to http://groups.google.com/group/moscb. You need to set up a Google account (free) to access the page. You will then be directed to request membership to the group. Approval can take a day or two, depending on how busy we (the group administrators) are. Please take the time to join the group as future issues of the Glade will be posted here.

Annual Meeting

Once again we will be planning to hold our annual meeting during the Missouri Natural Resources Conference January 30 – February 1, 2008 in Osage Beach . At this time no formal arrangements have been made, but we wish to hold the annual meeting at a time that will maximize participation. If you have strong preferences about when the meeting should be held (Wed. evening, Thurs. lunch, Thurs. evening), please contact me or one of the Executive Board members.

What is a weed? A plant whose virtues have not yet been discovered.

-- Ralph Waldo Emerson

Good "Weeds" We Should Learn to Love

Nadia E. Navarrete-Tindall, University of Missouri, Email: NavarreteN@missouri.edu

Call them aggressive, persistent, troublesome, or just call them weeds. They are here, always have been, and always will be. If you think I'm talking about introduced species, you're wrong. Some native plants, such as tall goldenrod (*Solidago altissima*), common boneset (*Eupatorium altissimum*), and common milkweed (*Asclepias syriaca*) are treated as undesirable because they show up uninvited, but they have their place in nature, whether we want them or not. These and many other native plants survive due to their ability to produce vast amounts of viable seed, and adapt to a wide range of habitats and disturbances. They are occur naturally in prairies, glades, open woods, fallow fields, roadsides, or vacant lots. In spite of their bad reputation they provide beauty and are the source of food and cover for butterflies and other insects. Native plants provide pollen and nectar for pollinators and other beneficial insects (http://nativeplants.msu.edu).

I was driving along I-70 between Blue Springs and Columbia in early September and I was amazed at how green and healthy these species and others look in some of the driest spots along the road. We have had an unusually hot summer and still these plants seem to thrive. Species like ironweed (*Vernonia fasciculata*) do much better in drainages where there is more moisture but they also grow in dry slopes. They are adapted to hot drought periods, like many other native prairie or savanna species. Tall goldenrod grows vegetatively and develops a fibrous root system before blooming in late summer or fall to escape the year's hottest period. When propagated from seed it can clone from rhizomes, forming dense colonies during the second year of growth. Goldenrod and boneset sprout even after severe pruning or mowing in late June and still bloom in late summer or early fall. Other species seen in harsh conditions are winged and smooth sumac, wild plum, and dogbane. These species all have something in common, they spread from seed and vegetatively and are usually considered weeds in gardens and crop fields. However, their importance in providing food and cover for many insects and birds is usually underestimated. They also provide some enjoyment---just think how boring a trip along I-70 would be without the presence of these bright colored native plants. They add color, and by providing habitat for butterflies, allow you to see a butterfly or two that manage to escape the traffic and your own windshield. (For species identification consult the Flora of Missouri webpage http://www.missouriplants.com.)

Monarch butterflies during migration stop to feed on tall goldenrod at a fallow field at Bradford Research Center in Columbia (2006).

Are you interested in finding out if you already have these plants in your garden? Try selecting an open spot and kill the grass either by covering with black plastic or with 1% glyphosate in the fall. In the spring, make a survey of all the seedlings in your treated area. Keep the area mowed until June, then start observing what you have there. If you need any help identifying your plants talk to a botanist or your nearest Native Plant Society. Take pictures for your records. Allow your plants to develop until they bloom in the fall. If you are interested in diversifying your new plant bed, plant other species in fall or early spring. You only need to water your plants during establishment if rain is not forecasted. Native plants do not need to be fertilized. If you prefer to plant shorter species than tall goldenrod, tall eupatorium, and common milkweed, you can choose *Solidago nemoralis, S. rugosa, S. rigida, E. rugosum, Asclepias tuberosa, A. incarnata,* and A. *purpurascens* among others.

Call them weeds if you want, but you can learn to love these plants. They don't ask for much and can give you a whole different world of nature in your yard.

The Future is Now: Climate Change and Resource Management

Esther Stroh, U.S. Geological Survey, Email: esther_stroh@usgs.gov

Everyone seems to be talking or writing about climate change these days. We have read and heard about changes in glaciers, sea level, permafrost, sea ice, weather patterns, and other environmental conditions, but what about changes to individual species? Often, when we speak about climate change effects on species, it is in the context of what may lay in store for species, and in terms of what future management responses we might take. Species' ranges are predicted to move poleward and upward as the climate warms. A frequently mentioned management response to this prediction is to consider assisted migration of species across heavily fragmented agricultural and urban areas. The idea of assisted migration has not been seriously debated among resource managers since it is contingent on first acknowledging climate change. However as evidence about the scope and effects of climate change emerges, more information is available that indicates the future is perhaps now. Climate change is affecting the lifecycles and territories of species in the present; the time to begin the dialogue about resource management response options is upon us.

In an article in Annual Review of *Ecology, Evolution, and Systematics*, Camille Parmesan (2006) reviewed 866 scientific papers addressing climate change published between 1899 and 2003, offering clear evidence of the impact climate change is having on individual species today. In the paper, Parmesan states (and provides copious supporting citations) that climate change impacts to biodiversity have not only been documented on every continent, in every ocean and across most major taxa, but also credibly attributed to twentieth century human-induced climate change. In other words, climate change effects are not a problem we will have to confront in our future; climate change has already affected Earth's biodiversity.

Citing many studies, Parmesan shows how the timing of phenological events have noticeably shifted in a variety of species Phenology is the timing of life history events, such as flowering, mating, or hatching; these events are often related to day length or temperature. People around the world have noted the timing of particular phenological events for centuries. For example, the timing of cherry blossoms in Japan and grape harvest dates in Europe has been recorded for 500 years. Analyses of these data and other sources (flowering of tree and shrub species, calling in frog species, first egg clutches for bird species, and first appearance of butterfly species, among others) have documented an advance in phenology of 2 days to 3 weeks per decade in the twentieth century. Many of the studies also document concurrent local warming (Parmesan 2006). Early phenological events reflect extended growing seasons in many locations that is usually due to earlier dates for last spring frost and later dates for first fall frost.

In addition to phenological changes, Parmesan (2006) documents climate-linked species range shifts for many taxa across the globe, including rapid advances of pest species and pathogens. She also discusses studies that demonstrate evolutionary and plastic responses to changing climate through changing genotype frequencies, body size, lengthening of time to diapause, and changing breeding dates. In spite of the evidence of local adaptation to changing climate, Parmesan argues that there is little evidence in the fossil record for major species-level evolution following Pleistocene glaciation. Instead, species shifted their geographic ranges in response to changing climates. She concludes (with supporting references) that while evolution can ameliorate some effects of climate change, there is little evidence to suggest that species can evolve climatic tolerances to allow them to retain their current geographic ranges.

Parmesan's review was written six years after the Intergovernmental Panel on Climate Change (IPCC) issued its Third Assessment Report in 2001. The IPCC was established by the World Meteorological Organization and the United Nations Environment Programme in 1988. It assesses and issues reports on scientific, technical and socioeconomic information related to understanding human-induced climate change. The IPCC Third Assessment Report (TAR, IPCC 2001) concluded that global temperature increases were "likely" (> 66% probability) a result of increased anthropogenic greenhouse emissions.

In spring of 2007, IPCC issued its Fourth Assessment Report (AR4, Alley and others, 2007) suggesting that the world is warming even more quickly than previously thought. It was authored by approximately 650 scientists and experts from 40 countries and reviewed by over 620 experts and governments; the summary report was reviewed line-by-line by representatives from 113 governments. The AR4 precipitated much of the recent media coverage on climate change. One particular statement in the report received much media attention at the time: "Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (Alley and others 2007). In IPCC terminology, "very likely" is used to indicate > 90% probability.

Not all areas of the globe are projected to respond to climate change in the same way, so regional predictions are made in the IPCC reports. In AR4, regional predictions for temperature and precipitation were made using output from twenty one climate models. The models used observed conditions from 1980-1999 and then projected temperature and precipitation for the period 2080 to 2099. In the report, model results are presented only if fourteen of the twenty one models agreed on the sign of the change (increase or decrease) for a given region. The authors of the report analyzed the signal-to-noise ratio for model outputs to produce a time estimate of when predicted changes will be detected in a region. Confidence in regional projections are higher than those presented in Third Assessment Report, due to improved models, a greater number and variety of simulations, better understanding of model weaknesses, and more detailed analysis of results (Christensen and others 2007).

Missouri falls in the approximate center of the Central North America region (CNA) analyzed in the AR4. This region extends roughly from Austin, Texas in the SW corner to the north shore of Lake Superior in the NE corner. The CNA projections are summarized in Table 1. In summary, the IPCC prediction for CNA region is warmer temperatures all year, especially in summer, and increased precipitation all year, except for summer, which is predicted to decrease. We will likely see the temperature increases before the predicted precipitation increases. Although the prediction is for generally increased precipitation, the signal-to-noise ratio is so great that it will take many more years before the signal of precipitation increase is likely detected.

Table 1. Projected climate differences for 2088 – 2099 relative to 1988-1999 for Central North America, modified from Christensen and others (2007). The table shows the minimum, median and maximum values among 21 climate models for temperature (°C) and precipitation (%) change relative to observed regional conditions from 1980-1999. DJF = DecJanFeb, MAM = MarchAprMay, JJA = JunJulAug, SON = SepOctNov. T Years = years until signal is detected.

	Temperature Response (ºC)*				Precipitation Response (%)				Extreme Seasons (%)		
Months	**Min**	**Med**	**Max**	**T Years**	**Min**	**Med**	**Max**	**T Years**	**Warm**	**Wet**	**Dry**
DJF	2.0	3.5	6.1	30	-18	5	14		71	7	
MAM	1.9	3.3	5.7	25	-17	7	17	>100	81	19	
JJA	2.4	4.1	6.4	20	-31	-3	20	>100	93		15
SON	2.4	3.5	5.8	20	-17	4	24		91	11	
Annual	2.3	3.5	5.8	15	-16	3	15		98		

***The interval size of a Celsius degree is 1.8 times the size of a Fahrenheit degree interval.**

From a natural resource perspective, we have Parmesan's argument that climate change has already affected biodiversity on a global scale, as well as the IPCC assessment that human activity is the very likely cause of recent climate change. In addition, we have projections that temperature increases could be detected within the professional careers of many of us. For resource managers, this means that climate change effects could be just as immediate a threat to biodiversity as are invasive species or habitat degradation and fragmentation and may affect forestry, fisheries, and agricultural activities. Moving species around is a public policy question that states and nations need to address. For scientists, it means a staggering array of questions regarding which species are most likely to be negatively affected by climate change, whether mutualist species will respond in synchrony, and, if at-risk species can be identified, how to determine the desired genetic qualities of potential source populations for relocation efforts. We need to increase our scientific understanding of what constitutes an ecosystem versus an assemblage of species, whether different species can perform equivalent ecological functions, whether there are emergent qualities of a native ecosystem that cannot be reconstructed piece by piece and so on.

Responding to climate change will require unprecedented collaboration among scientists, resource managers, policymakers and human communities, from local to national levels. McLachlan and others (2007) outline a framework that can be used to begin a dialogue on assisted species migration, a frequently proposed management option that has not yet been systematically employed (Fox 2007, McLachlan and others 2007). Their framework consists of weighing the perceived risks of assisted migration with the perceived risks of inaction against the level of confidence in current ecological understanding. They urge the development of flexible management options that can be adjusted in response to new scientific information, but caution there is no time to wait for better data. Using a modern cliché, they assert that we must respond "with the army we have, not the army we want" (McLachlan and others 2007).

The Missouri Chapter of SCB will sponsor a workshop on climate change effects on Missouri biodiversity (see President's Column for details). We hope to begin a dialogue among Missouri resource professionals and scientists about how we might begin to plan for and manage climate change effects in our state.

Note: Most of the results presented in the IPCC Regional Assessment are based on predictions from an emissions scenario known in the climate modeling world as A1B. This scenario projects a future world of very rapid economic growth, mid-century global population peaks followed by population declines, rapid introduction of new and more efficient technologies, and a balanced reliance on a variety of energy sources. In other words, model assumptions go beyond the physical world and touch on policy responses that could alter the final observed conditions. All IPCC Fourth Assessment reports are available free online at http://www.ipcc.ch/. The regional climate projections chapter and all others in the Working Group I report can be accessed at http://ipcc-g1.ucar.edu/wg1/wg1-report.html.

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An Update on Two Critically Imperiled Crayfishes from Southwest Missouri

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Recently completed field surveys for two of Missouri's rarest crayfishes concluded that searching harder is sometimes rewarded…but not always. During the summers of 2002 through 2004 MDC crayfish biologists scoured 71 of the total 223 stream segments in the White River drainage in 10 southwest Missouri counties, looking for two "critically imperiled" crayfish species. The "critically imperiled" designation is assigned to species that are extremely rare in the state or nation and vulnerable to extirpation. Williams' crayfish (*Orconectes williamsi*) and Meek's crayfish (*Orconectes meeki*) are thought to occur in the upper White River drainage of Missouri and Arkansas, and nowhere else in the world. Prior to the surveys Williams' crayfish was known from only nine Missouri locations in Barry, Christian, Stone and Taney counties. Meek's crayfish was known from only three sites in Stone County.

Our objectives were to reevaluate the distribution and conservation status of the two crayfishes and identify habitat factors that influence their presence. We studied 22 habitat features for each stream segment, from small-scale features such as water current velocity, water depth, and the size of rock shelters used by the crayfishes, up to large-scale features such as the underlying geology and watershed size. Identification of habitat features influencing crayfish presence is important because it will help biologists fine tune future surveys and identify stream segments where we might focus management and conservation efforts.

We found Williams' crayfish at 34% of the sites we searched, including 20 previously undocumented locations. However, we were unable to find this crayfish at two of the nine previously known locations. In total, 27 stream segments in Barry, Christian, Stone, and Taney counties are now known to harbor William's crayfish; most are immediately surrounding and to the east of Table Rock Reservoir. Our habitat studies taught us that Williams' crayfish prefers softball- to basketball-sized rock shelters in fast-flowing areas of small creeks. Also, this crayfish was found only in stream channels that had not been disturbed by siltation/sedimentation and streambank erosion brought about by poor land management practices.

Unfortunately, we found Meek's crayfish at only 8% of searched stream segments (6 total sites), and at only one of the three previously known locations. Nearly all six stream segments containing Meek's crayfish were close to and drained directly into Table Rock Reservoir. Meek's crayfish habitat included baseball- to basketball-sized rocky shelters that were free of silt and fine sediment in very small streams that cut through limestone and dolomite rock.

The White River drainage of Missouri is peppered with more than 75 former and active lead and gravel mines. Studies also show poor land use practices increasing in the drainage, often related to the rapidly increasing urbanization in places that were formerly rural. All of these activities potentially affect water quality and stream habitats, as well as aquatic life including crayfishes. Many streams harboring Williams' crayfish and most Meek's crayfish streams are isolated or "fragmented" from each other by Table Rock and Bull Shoals reservoirs, causing additional concern for their long term conservation. Fragmentation becomes a serious problem when populations decline or are eliminated from one or more of these streams. These stream-dwelling crayfishes are not able to travel through the reservoir to recolonize streams that have suffered declines. The fragmentation also contributes to genetic inbreeding within individual streams.

Our crayfish surveys provided a more promising outlook for Williams' crayfish than we had previously. Our findings justified downgrading this species' state conservation designation from critically imperiled to imperiled. But we did identify potential threats and the species will have to be closely monitored. Unfortunately, we learned that "the meek", or at least Meek's crayfish, will probably not be "inheriting the Earth" or even southwest Missouri, anytime soon. This species certainly deserves its state rank of critically imperiled, and will require careful management in the future.

The Glade
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When one tugs at a single thing in nature,
he finds it attached to the rest of the world. --John Muir

Membership Information

The goal of MOSCB is to promote communication among conservation biologists throughout the state of Missouri. Membership in MOSCB is $5.00 (esther_stroh@usgs.gov). Please contact one of the Board members for more information – and bear with us as we transfer web site locations.

The Glade Vol. 10, No.2 was edited by Todd Jones-Farrand (FarrandD@missouri.edu). Special thanks to the authors in this issue for their time and thought in writing their articles. Funding for this issue of *The Glade* was provided by contributions from members of MOSCB.