ILLINOIS NATURAL
HISTORY SURVEY
PRAIRIE RESEARCH INSTITUTE

Assessing Vulnerability of Coolwater Habitats in Illinois Wadeable Streams: Annual Report 2015

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Annual Summary Report

Project Title:
Assessing Vulnerability of Coolwater Habitats in Illinois Wadeable Streams.

Project Number: T-83-R-001

Contractor information:

University of Illinois at Urbana/Champaign
Institute of Natural Resource Sustainability
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Annual Reporting Period: 1 October 2014—30 September 2015

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Goals/ Objectives: (**1)** Identify coolwater habitats and associated fish species on Illinois' wadeable streams; (**2)** Characterize thermal and flow regimes under current conditions and scenarios describing landcover and climate change; (**3)** Assess vulnerability (sensitivity and exposure) of thermal and flow regimes to landcover and climate changes for coolwater reaches; (**4)** Examine potential changes in fish species distributions and connectivity of their associated habitats; (**5)** provide annual and final reports that include an assessment of vulnerability to alterations in landcover and climate projected to occur in Illinois.

Project Title:
Assessing Vulnerability of Coolwater Habitats in Illinois Wadeable Streams.

Narrative:

We continue to work with IDNR staff to assure that our GIS data are compatible with upgrades to their system. Summaries of landuse/landcover, surficial geology, and other GIS derived attributes for upgraded linework are only now becoming available for project use. Due to these ongoing efforts to consolidate GIS data with IDNR staff we reduced our time commitment on this project during the reporting period and requested a one year no-cost extension. The equivalent of 0.6 FTE research scientist was employed during this reporting period to support this work. We also employed one summer hourly worker to assist with data entry, analysis, and ongoing temperature monitoring.

Work during this reporting period focused on maintaining field based water temperature loggers at over 30 locations in Illinois streams and three water level loggers on Wade Creek. We also conducted a fish sampling effort to determine the presence of target species in a currently monitored reach where no recent fish surveys have been conducted. All available temperature data has been summarized.

Job 1: Identify coolwater habitats (reaches) on wadeable streams in Illinois and their associated fish species in greatest need of conservation.

We compiled existing water temperature records from over 200 sites statewide and classified each record based on the mean daily temperature (MDJT) from the month of July. Sites with MDJT below 22 degrees Celsius were considered coolwater and will be further characterized in subsequent Jobs (Hinz et al. 2011). Georeferenced locations of key coolwater fish species identified in our previous project (Hinz et al. 2011) were also reviewed statewide based on available information (Metzke et al. 2012).

Based on these reviews we selected stream reaches with known locations of three fish species (Brook Stickleback, Longnose Dace, Mottled Sculpin) associated with coolwater temperatures in Illinois streams (Hinz et al. 2011) to be the focus of collecting additional information and to constrain the vulnerability analysis (Figure 1). The majority of these sites have been visited during the project (see Job 2).

This job has been completed by identifying coolwater habitats using existing resources.

Job 2: Characterize thermal and flow regimes of identified coolwater reaches under current conditions and several scenarios describing changes to landcover and climate.

We reviewed available climate downscaling data associated with an ongoing Upper Midwest Great Lakes – Landscape Conservation Cooperative project (Jason Robinson, INHS). These data will be integrated into our GIS system when upgrades have been completed. This work is ongoing.

Instream monitors have been deployed at characterization sites to record water temperature at either one hour or 15 minute intervals. Water temperature loggers maintained at these and additional sites (Figure 1). All available temperature records were summarized for each location (Figure 2). Monitoring sites have spanned a range of temperatures but most sites have maintained temperatures in the coldwater to coolwater range during the project period (Figure 3).

Water level logger data on Wade Creek were similarly downloaded and summarized. Additional discharge measurements were made during several different water levels to assist with calibration. Further characterization (i.e., modeling) of the thermal regime and flow regime of stream reaches requires the completion of upgrades to stream linework and associated summaries. This work is ongoing.

We conducted a survey on Wade Creek to document the presence of fish species along a known coolwater reach. American Brook Lamprey (Illinois Threatened Species), Brook Stickleback (Illinois coolwater obligate species, Hinz et al. 2011), Blacknose Dace (Illinois coolwater associate species, Hinz et al. 2011), Common Shiner, Creek Chub, Johnny Darter, Green Sunfish, Central Mudminnow, White Sucker, Fathead Minnow, and Central Stoneroller were all observed during the survey.

A test of the existing water temperature model (Hinz et al. 2011) was undertaken using the updated linework within the Rock River EDU (Figure 4). Some stream segments appear to be cooler using the updated linework than they were using the earlier version (Figure 4). Further characterization (i.e., modeling) of the thermal regime and flow regime of stream reaches requires the completion of upgrades to stream linework and associated summaries for the remainder of the state. This work is ongoing.

Job 3: Assess the vulnerability (exposure and sensitivity) of coolwater reaches to potential landcover and climate changes based on alterations of thermal and flow regimes.

Further assessment of the vulnerability of stream reaches requires the completion of upgrades to stream linework and associated summaries. This work has been delayed but is ongoing.

Job 4: Examine potential changes in fish species distributions and connectivity of habitats associated with landcover and climate change scenarios.

Work on this job requires further progress on Job 2 and Job 3. We have continued to work with colleagues at INHS on species specific distribution models for key fish species of interest in this project. We have applied distribution models for 73 fish species and developed maps at the reach level for all wadeable streams in Illinois (Cao et al. 2015). This work has been delayed but is ongoing.

Job 5: Prepare reports and manuscripts.

This Annual Report was prepared. Work associated with this project was presented at the Annual Meeting of the Society for Freshwater Science.

Coolwater stream habitats are uncommon in Illinois but they support several species of conservation concern. These streams maintain thermal habitats for a broad array of species so even small changes in temperature can shift thermal regimes to the point where local populations are impacted. Coolwater habitats were identified using observed temperatures meeting our temperature threshold (mean daily July temperature < 21.5 °C) and known locations of fish species previously associated with coolwaters in Illinois (Brook Stickleback, Longnose Dace, Mottled Sculpin). To assess the vulnerability of these coolwater habitats we are monitoring stream temperature at 31 sites in northern Illinois and developing statewide stream temperature and fish distribution models using existing data. These models will be used to assess the vulnerability (exposure and sensitivity) of coolwater habitats to changes in landcover and climate by examining a range of potential conditions. Further analysis will examine how thermal regimes of coolwater reaches are influenced by geologic, climatic and landcover characteristics. We will also examine potential changes in fish species distributions and functional isolation of coolwater habitats associated with landcover and climate change scenarios.

References

Cao, Y., L. Hinz, B. Metzke, J. Stein, and A. Holtrop. 2015. Modeling and mapping fish abundance across wadeable streams of Illinois, USA based on landscape-level environmental variables. Canadian Journal of Fisheries and Aquatic Sciences.

Hinz Jr., L. C., B. A. Metzke and A. M. Holtrop. 2011. Evaluating water temperature, habitat, and fish communities in candidate coolwater streams in Illinois. Final Report to the Illinois Department of Natural Resources. Illinois Natural History Survey Technical Report 2011/21.

Hinz Jr., L. C., B. A. Metzke and J. Vandermyde. 2013. Hierarchical Framework for Wadeable Stream Management and Conservation: Annual Report 2013. Illinois Natural History Survey Technical Report 2013/29.

Metzke, B.A. L. C. Hinz Jr, and A. C. Hulin. 2012. Status Revision and Update for Illinois' Fish Species in Greatest Need of Conservation. Final Report to the Illinois Department of Natural Resources. Illinois Natural History Survey Technical Report 2012/19.

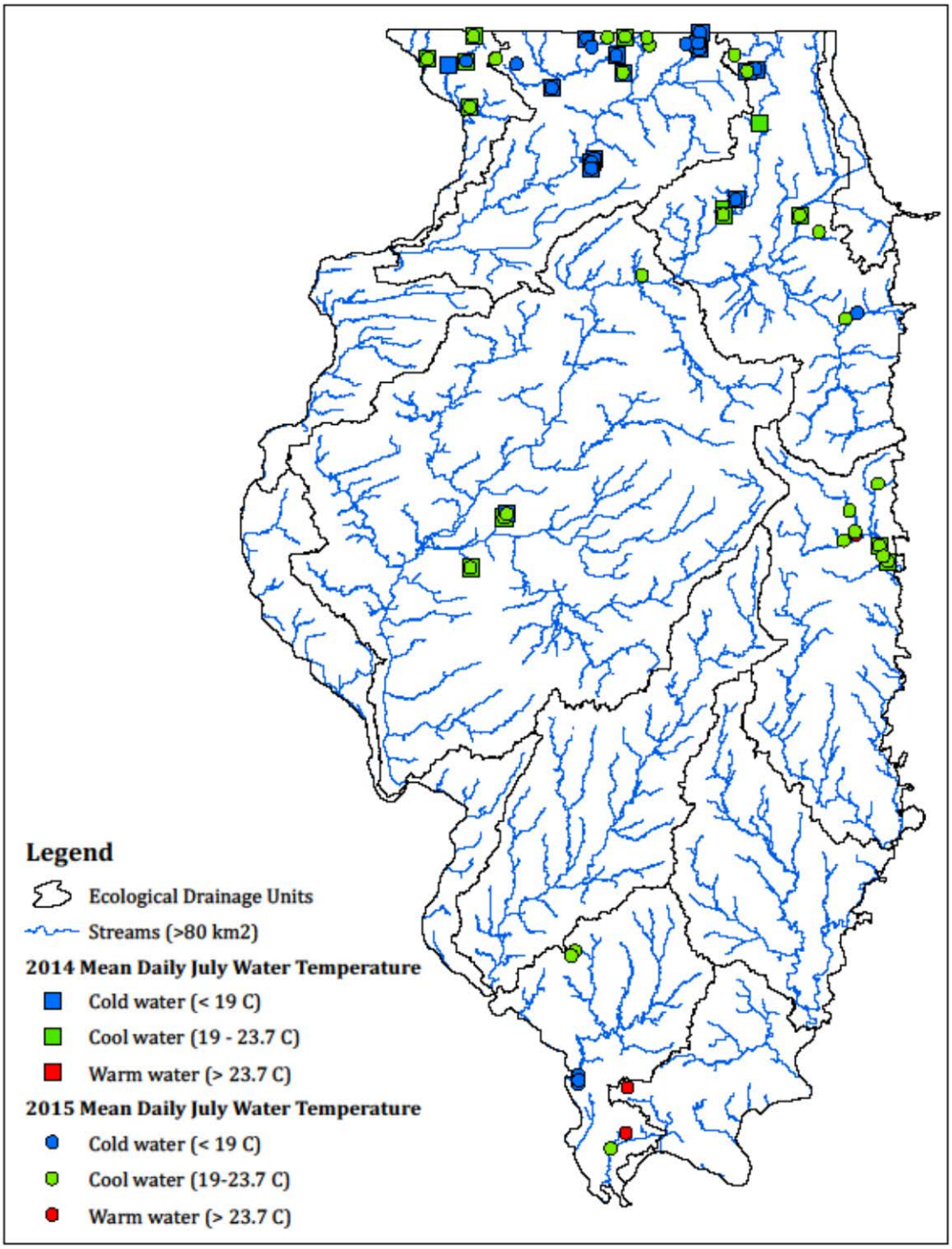


Figure 1. Sites selected to further characterize for vulnerability to climate and landuse change. Water temperature monitors were deployed at each of these locations in spring of 2014 or 2015 and continue to collect information.

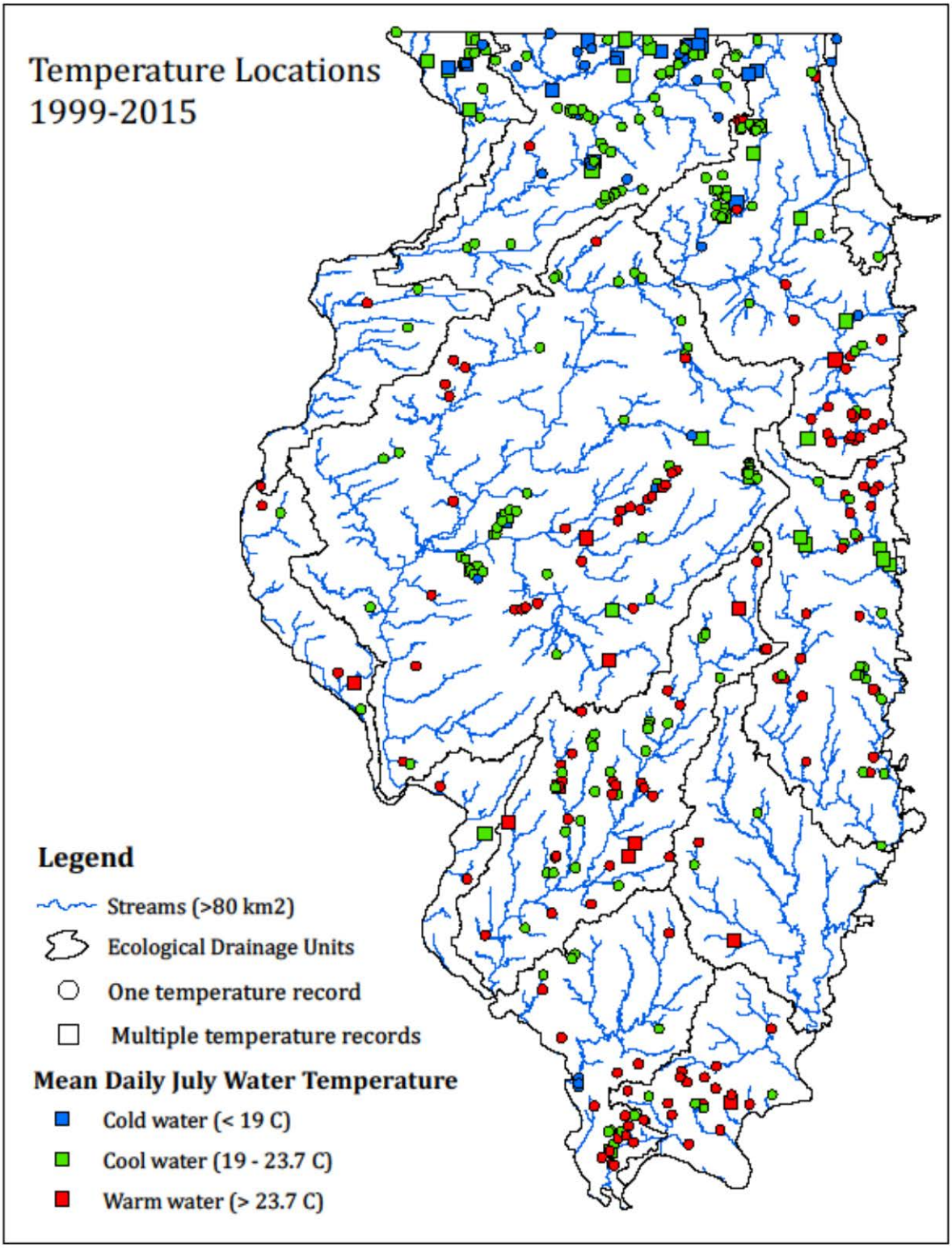
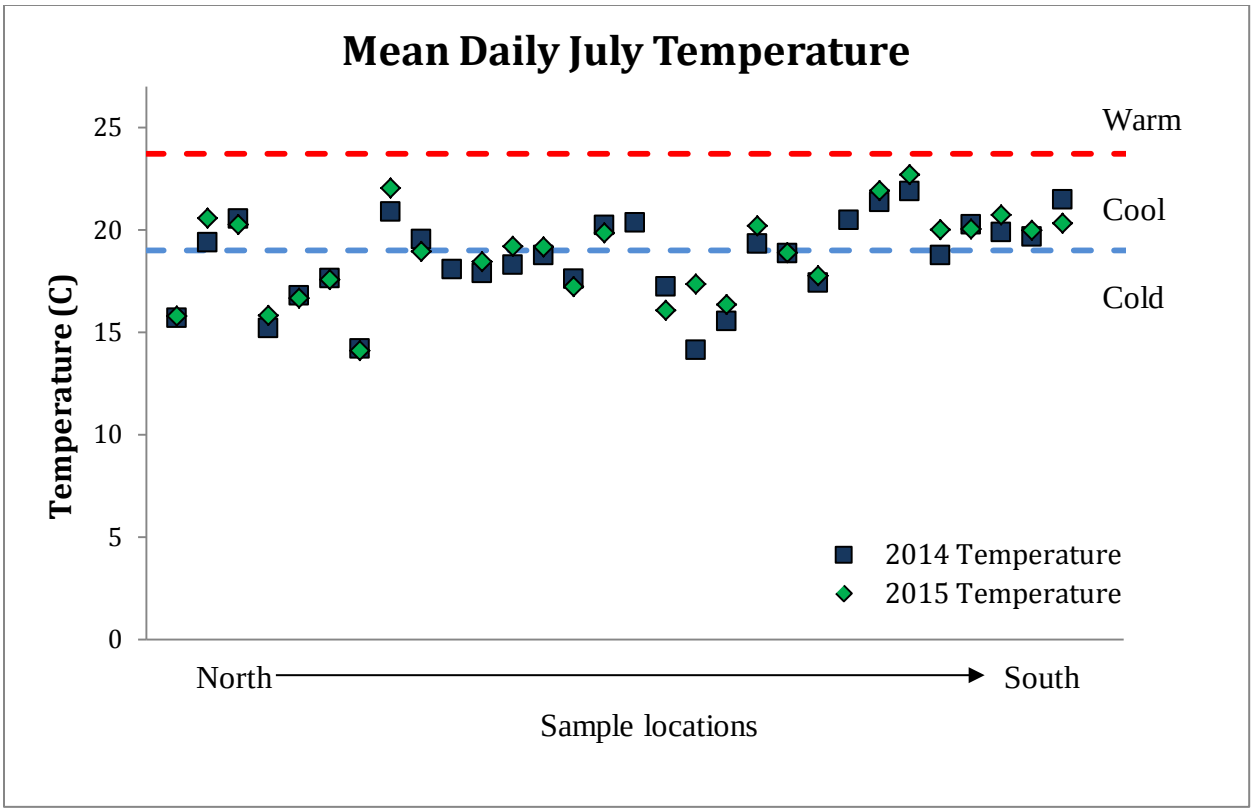


Figure 2. Stations with water temperature monitoring data from Illinois streams. Most stations have information from a single year. Sites with multiple years display the mean condition for all years with available data.



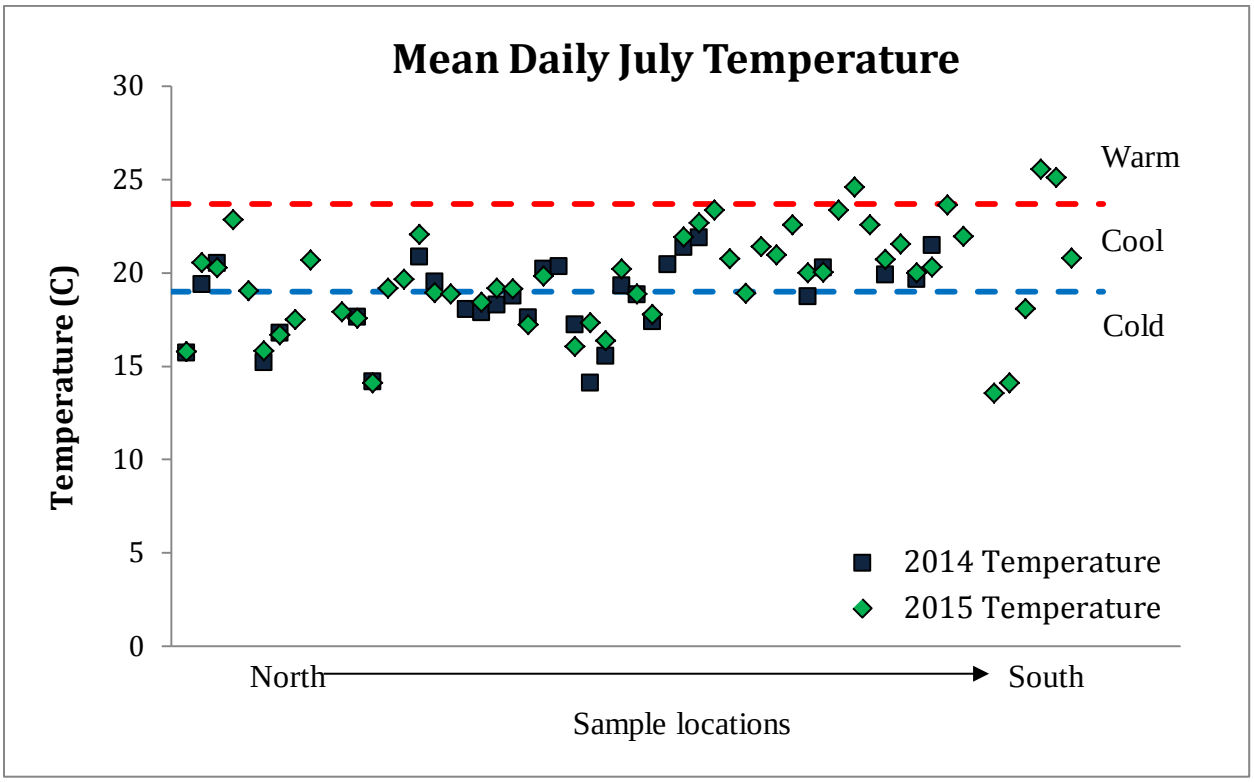


Figure 3. Observed temperatures at monitoring sites. Top: Only sites that were sampled both years. Bottom: All sites. Temp categories are from Hinz et al. 2011.

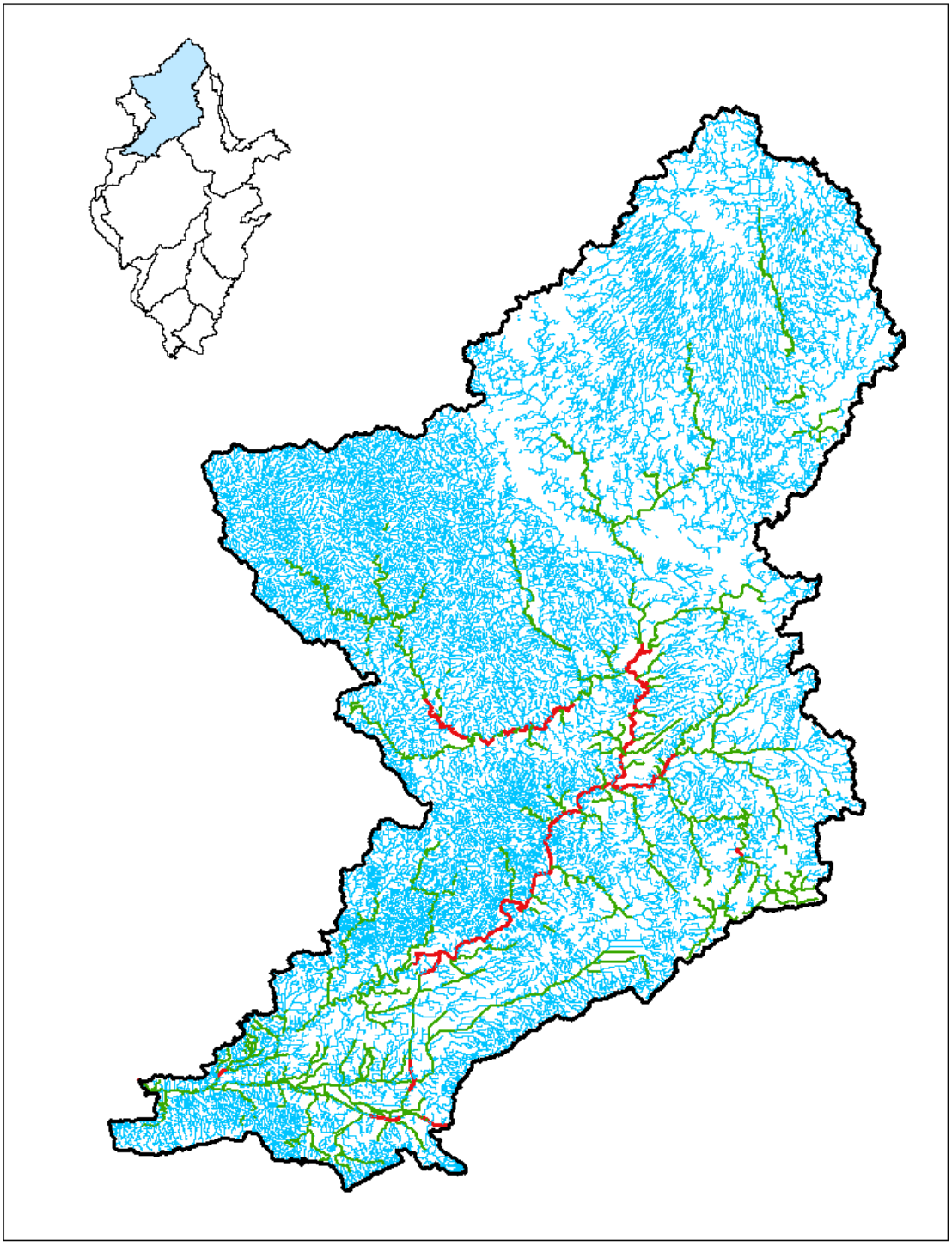


Figure 4. Modeled thermal classes based on the existing water temperature model to the updated 1:24,000 linework and summaries.

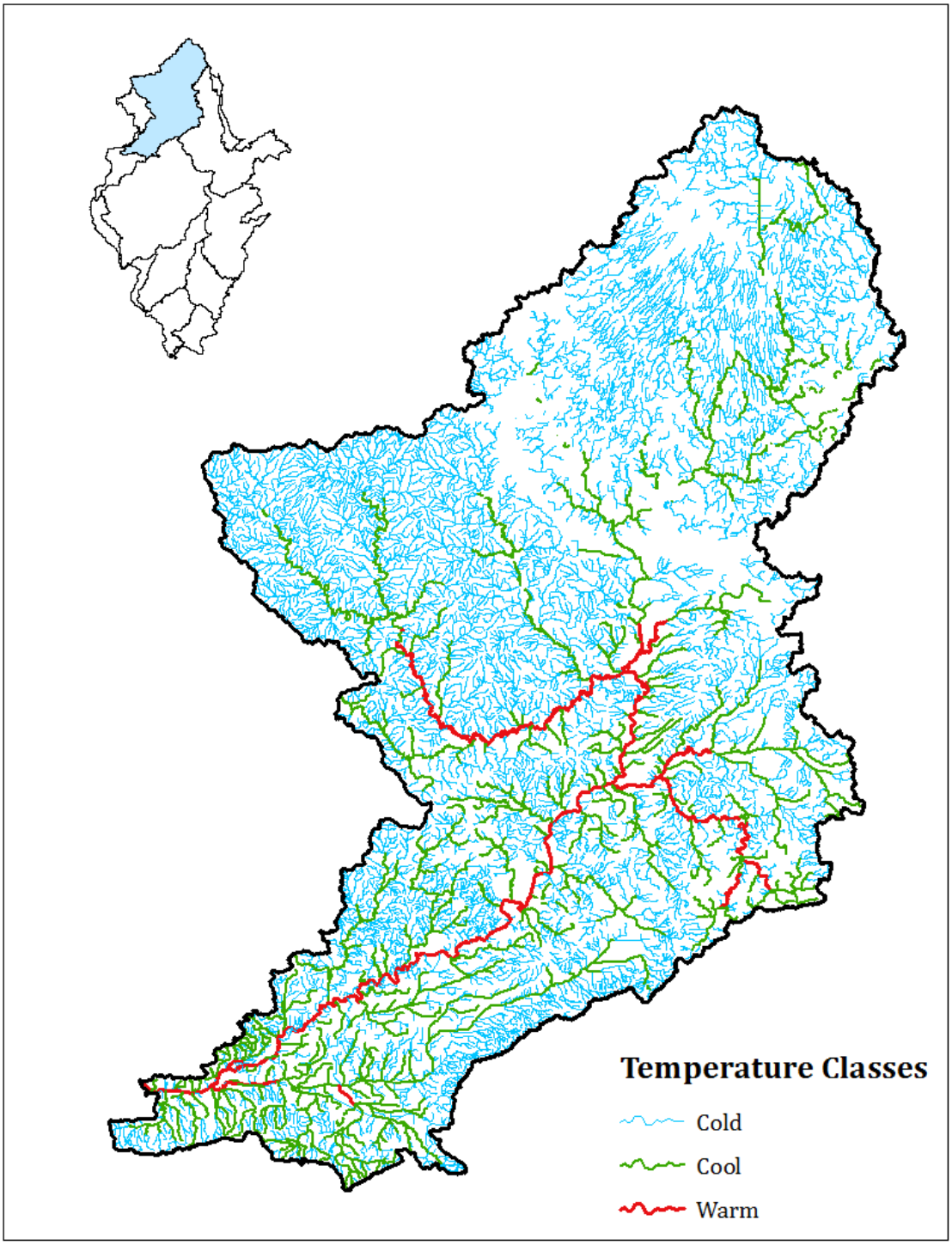


Figure 5. Modeled thermal classes based on the existing water temperature model applied to the 1:100k linework that was used to develop the temperature model.