



NATIONAL *fish, wildlife & plants*
CLIMATE ADAPTATION STRATEGY

Project Title: Protecting coldwater fish in Minnesota from climate change: Building resilience in deep lakes using a landscape approach

Headline Title (2-5 words): Protecting coldwater fish in Minnesota

Brief Summary (Abstract): By protecting the water quality in 176 “refuge” lakes, coldwater fish such as cisco are expected to persist in Minnesota, even after climate warming.

Project Location: Northern and Central Minnesota

Partners: Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Board of Water and Soil Resources, the University of Minnesota.

Background: Coldwater fish such as cisco, lake whitefish, and lake trout have a requirement for cold, well-oxygenated water and primarily live in deep lakes in Minnesota that have good water quality. This requirement makes them especially vulnerable to two of the greatest threats for Minnesota lakes – eutrophication and climate warming. In the summer, coldwater fish live in the cold water below the thermocline in most Minnesota lakes. Unfortunately, oxygen concentrations below the thermocline decline throughout the summer in many lakes, especially in more eutrophic systems. Loss of water quality increases the rate at which dissolved oxygen is lost below the thermocline. As more phosphorus (the key nutrient limiting algal production in most Minnesota lakes) runs off from poor land use practices in a watershed, more algae is produced in the upper layers of a lake. As these algal cells die and settle into the deeper portion of the lake, decomposition consumes oxygen, and concentrations decline in the water below the thermocline. As the upper layers of the lake warm, coldwater fish can experience a “squeeze” as they move up in the water column to avoid low oxygen concentrations. In some summers, the squeeze is so great that some will die as they get forced into lethally warm temperatures.

Fortunately, many deep lakes with good water quality maintain adequate oxygen conditions below the thermocline all summer long, even in warm summers. The Minnesota DNR Fisheries Research Unit, in conjunction with the University of Minnesota, have identified 176 “refuge” lakes in Minnesota that are deep and clear enough to sustain cisco, even after climate warming. Maintaining the water quality in these lakes is critical for them to function as refuges to climate change. The Minnesota Department of Natural Resources is starting to protect the water quality in these important lakes. Partnering with other state agencies such as the Minnesota Pollution Control Agency and Board of Water and Soil Resources, local units of government, and lake associations will be a key strategy for protecting water quality. These strategies will primarily focus on keeping the forested lands forested in the watersheds of these lakes (most are located in the forested portion of Minnesota).

Project Goals: Protect the water quality in 176 coldwater “refuge” lakes by keeping forested watersheds forested.



Strategy Goals Implemented: The Minnesota Department of Natural Resources Division of Forestry is working with landowners in the watersheds of refuge lakes to make sure they keep their forested lands forested through private forest management plans, tax incentives, and conservation easements.

Climate Impacts Addressed: Climate effects on coldwater fish in lakes.

Status of Project Implementation (Timeline, Milestones, Next Steps): Minnesota DNR Division of Forestry is actively using Clean Water Legacy funding to protect private forest lands in the watersheds of refuge lakes: <http://www.dnr.state.mn.us/tullibeelake.html>

Project Outcomes: Protection of coldwater fish in 176 Minnesota lakes.

Funding Sources: Minnesota Clean Water Legacy



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Photos/Attachments:



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Suggested Photo Caption: Dead cisco during a mortality event on Lake Andrusia, Minnesota in the unusually warm summer of 2006.