

# Scenarios for the Future of Lake Wingra

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prepared by the students of  
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40 **Summary**

41  
42 Lake Wingra (Madison, Wisconsin) is an urban lake that is used by the public in many ways. The  
43 lake adds to the natural beauty of surrounding lands that contain Edgewood College, the University  
44 of Wisconsin Arboretum, Vilas Zoo, and public parks. Diverse users enjoy boating, fishing and  
45 swimming in the lake. The lake receives runoff waters from an urban watershed. These carry  
46 sediments and pollutants, such as nutrients and road salt. Lake Wingra is eutrophic due to excessive  
47 phosphorus inputs. The lake harbors some harmful exotic species, including common carp and  
48 Eurasian water milfoil.

49  
50 There is widespread interest in improving and sustaining the amenities provided by Lake Wingra  
51 and its shorelands. Friends of Lake Wingra (FOLW), a non-profit organization of citizens  
52 concerned about the lake, has organized input from many diverse people and groups to develop an  
53 evolving set of goals for the lake and its watershed.

54  
55 We developed scenarios to evaluate plausible changes during the next generation (to 2035) that  
56 could affect the implementation of goals for Lake Wingra. This report presents a short introduction  
57 to the scenario process, the goals for Lake Wingra that have emerged from the FOLW process so  
58 far, a description of the current state of the system that we considered, and the draft scenarios. The  
59 four scenarios are:

- 60  
61 ➤ **Garden State:** Propelled by expanding concern for the global environment, enormous  
62 investments are made in green technology. Environmental groups in Madison are gradually  
63 assimilated by powerful global environmental organizations. This shift of influence to larger  
64 scales affects Madison's approaches to local environmental issues such as Lake Wingra.  
65  
66 ➤ **Big Green Brother:** Grassroots organizations like FOLW transform government. Stronger  
67 steps are taken to address local environmental needs, including restoration of Lake Wingra.  
68 The new institutions gradually become more narrowly focused and less responsive to  
69 evolving needs. This rigidity meets a severe challenge when a deep, persistent drought  
70 strikes the Madison area.  
71  
72 ➤ **C-Clear:** Local organizations develop increasingly successful innovations for managing  
73 Lake Wingra. Use of the lake expands and the institutions become more diverse reflecting  
74 the expanding user community. But intensifying use brings greater conflict among different  
75 interest groups. A spiraling cycle of emerging issues continually challenges those who wish  
76 to conserve Lake Wingra.  
77  
78 ➤ **Exotic Exchange:** Success in removing exotic invaders creates an ecological vacuum and  
79 also exposes unexpected conflicts among user groups. A new harmful invader fills the  
80 ecological vacuum. This catalyzes change and refocuses management efforts.

81  
82 The scenarios are a work in progress. We do not yet consider them to be in final form. The report  
83 closes with information on how readers can participate in the ongoing process of creating a better  
84 future for Lake Wingra and its watershed.

85

## 86 **Introduction**

87  
88 How might Lake Wingra look in 2035? Will it be a valued community resource, where residents  
89 enjoy swimming, paddling or fishing? Could it provide a home to the variety of native plant and  
90 animal communities that once thrived in the Madison lakes? Or might Lake Wingra degenerate into  
91 smelly backwater, unsafe and unpleasant for people and wildlife alike?  
92

93 These are the questions a group of graduate students at the University of Wisconsin-Madison have  
94 asked in partnership with the Friends of Lake Wingra (FOLW). To help FOLW develop strategies  
95 to meet the organization's social and ecological goals for the watershed (Box 1), we developed a set  
96 of stories about how the Madison area may develop over the coming 30 years in response to  
97 different internal or external forces. We used a scenario planning approach.  
98

99 Scenario analysis is a particularly powerful tool for considering different ways in which the future  
100 might unfold. Scenario analysis was first used as a method for war game analysis after World War  
101 II, but is now applied in a wide variety of contexts such as business planning, political  
102 transformation, and environmental management (Shoemaker 1993, van der Heijden 1996).  
103 Scenarios are not predictions, but rather plausible stories about how the future might unfold. They  
104 are designed to challenge our assumptions, and encourage us to open our minds to potential future  
105 changes or surprises. Scenarios do not incorporate the full range of possibilities that the future  
106 might bring, but rather explore a handful of particularly illustrative or thought-provoking possible  
107 futures. Scenarios may simply take the form of qualitative stories, or represent some combination of  
108 qualitative stories and quantitative modeling.  
109

110 This report presents four qualitative scenarios that we developed for the Madison area.  
111 The scenarios were developed over a three month period during our weekly seminar meetings (Fig.  
112 1). Representatives from FOLW were present at our weekly meetings, and contributed to our  
113 discussions. To generate the initial set of scenarios, we held a brainstorming workshop to which we  
114 invited community stakeholders representing a range of institutions directly or indirectly involved  
115 with the management of Lake Wingra (see Appendix 1). Once the set of storylines had been decided  
116 on and developed, we discussed them individually with several community stakeholders to obtain  
117 feedback on the plausibility and usefulness of the scenario set. The scenarios were then revised to  
118 incorporate these comments, and formally presented to the FOLW on 9 May 2007.  
119

120 The purpose of this document is to synthesize and formally record the scenarios we developed. In  
121 each scenario we attempted to address the potential impacts the scenario might hold for the FOLW  
122 goals. We did not attempt to consider potential strategies FOLW may adopt under the different  
123 scenarios, or to identify potential threats or opportunities across the scenarios. We leave the  
124 possibility of doing so to FOLW and other readers of this report. Lastly, we note that these  
125 scenarios may present a useful tool for engaging stakeholders in discussions about the future of  
126 Lake Wingra and their communities, and how individuals and institutions might contribute to  
127 building the kinds of futures they desire.

128



129

130

131 **Fig. 1.** Process used to develop the Lake Wingra scenarios during our weekly graduate seminar  
132 meetings. Weeks during which we covered scenarios literature are not shown.

133

### 134 **Goals for Lake Wingra**

135

136 Friends of Lake Wingra (FOLW, <http://lakewingra.org>) is a group of private citizens interested in  
137 the conservation of Lake Wingra. FOLW is developing a set of evolving community goals for the  
138 future of Lake Wingra. In the following two pages, we present the draft goals as of the time of  
139 writing (7 May 2007). We emphasize that this is an evolving document, subject to change in the  
140 future.



# Friends of Lake Wingra



Promoting a healthy Lake Wingra  
through an active watershed community

141

142

## 143 **Goals for a Healthy Lake Wingra: Where We Want to Be in 2030**

144 *Lake Wingra is a unique community resource that contributes to the quality of life of a much larger*  
145 *geographic region. The lake and its surroundings support diverse open spaces and natural habitats*  
146 *that are protected, restored, and regenerated for future generations, and provide refuge from the*  
147 *noise, lights, and pavement of the surrounding urban area. People, plants, and animals benefit from*  
148 *this oasis within the city.*

## 149 **A Healthy Lake**

150 **Clear, Clean Water:** The lake water is free from excessive pollutants, and clear enough for people  
151 to see their feet when standing waist-deep.

152 The lake has moderate productivity without large algae buildups. Sunlight reaching deeper water  
153 supports diverse aquatic plant and animal communities, which are visible to Lake users. The  
154 "Trophic Status Index" (as calculated from water clarity, phosphorus level, and chlorophyll plant  
155 pigment measurements) does not exceed a value of 50. Average annual chloride levels do not  
156 exceed 40 mg/L. Toxic heavy metal and organic pollutants are below detectable levels.

157 **Restored Spring Flow:** Cool, clear spring water replenishes the lake, and maintains year-round flows into  
158 Wingra Creek.

159 The hydrological conditions and ecological value of the lake and its shoreline are enhanced and, to  
160 the extent practical, restored. The Lake becomes predominantly groundwater fed. Protection and  
161 recharge of groundwater throughout the watershed increases flow from existing springs, and renews  
162 "lost" springs.

163 **Native Plants and Animals:** The ecology of the lake and its surroundings are enhanced by the  
164 protection and restoration of habitats for a wide variety of plant and animals.

165 Lake, wetland, and terrestrial habitats provide refuge for common, endangered, and threatened  
166 native species. Non-native and invasive species are under control. Lost or threatened habitats (e.g.,  
167 sedge meadows, fens) and species (e.g., wild rice) have been restored or enhanced. Species  
168 richness (total number of species) remains high and indicative of comparable high-quality  
169 ecosystems in the region. Diverse habitats attract resident and migrating birds. No new invasive  
170 species have been established.

## 171 **Stewardship and Enjoyment**

172 **Public Access:** Lake Wingra's unique amenities are accessible to responsible public use and  
173 support a wide range of complementary recreational activities in all seasons.

174 Citizens are good stewards of the lake and its watershed. Policies are in place to avert user conflict  
175 and prevent a "tragedy of the commons" caused by overuse.

- 176 **Swimming:** The Lake is healthy and attractive for swimming.  
 177           There are no beach closings due to elevated bacterial levels or other standard measures of safe  
 178           swimming conditions.
- 179 **Fishing:** The fishery meets the needs of many types of anglers; fish are safe and delicious to eat.  
 180           Populations of native species, able to reproduce naturally in the lake, make up the foundation of the  
 181           fishery. Opportunities range from sport fishing by boat to subsistence fishing from the shoreline.
- 182 **Boating:** An emphasis on quiet use provides a refuge for paddling and sailing.,  
 183           Water trails provide access to paddlers throughout the lake and its associated waterways (including  
 184           Wingra Creek and Gardner Marsh). The lake surface is calm (weather permitting).
- 185 **Nature Viewing:** The lake and its surroundings abound with opportunities to view a large variety of  
 186           species (such as coyotes, otters, dragonflies, orchids, turtles) and natural features (such as springs,  
 187           fens, and sedge meadows). The shoreline is recognized as a “dark sky preserve,” without obtrusive  
 188           lights.
- 189 **Learning:** The lake and its surroundings act as a magnet for learning, drawing individuals, youth  
 190           programs, schools, and families.  
 191           People know about the lake from excellent print and internet material and also from experiential  
 192           learning that involves them in hands-on observation, reflection, monitoring, and action.
- 193 **Restoring and Enhancing:** People of all ages are engaged in activities that restore and enhance the  
 194           ecological importance, natural beauty, and recreational value of the lake and its surroundings.  
 195           Volunteers assist with restoration of native plantings on public property. Property owners manage  
 196           storm water runoff, favor healthy lawn and garden practices, and plant rain gardens. Caring for the  
 197           lake through individual and collective action is the norm, and it is fun.

## 198                                   **Management Strategies: How We Can Get There**

- 199 *After the Friends of Lake Wingra completes a review of the above goals by citizens and partner*  
 200 *groups, the next step will be to develop concrete strategies and measurable outcomes. These will*  
 201 *include strategies that address both ecological management and social/political management. Many*  
 202 *of these strategies have already been developed in existing Storm Water, Invasive Species, and*  
 203 *Citizen Stewardship management plans (see FOLW Library at <http://lakewingra.org>). To get*  
 204 *involved, contact the Friends at [info@lakewingra.org](mailto:info@lakewingra.org) or 608-663-6921.*
- 205 **Ecological Management** includes attention to surface & groundwater hydrology, stormwater,  
 206           ecosystem services, invasive species, and Wingra Creek restoration.
- 207 **Social and Political Management** includes attention to urban redevelopment, coordinated  
 208           leadership, planning and action (government, business, and nonprofits), citizen stewardship, schools  
 209           (curriculum development, action learning), and regional land use and transportation.  
 210
- 211 ~~~~~~ END OF FOLW DOCUMENT ~~~~~~

212 **Systems Analysis: What Are We Talking About?**

213

214 Systems analysis is an essential step at an early stage in a scenarios exercise. Our systems analysis  
215 addressed the following issues:

216

217 ➤ What is the question to be addressed by the scenarios exercise?

218

219 ➤ What are the boundaries of the system? What is the spatial grain of the analysis?

220

221 ➤ What is the time horizon? What is the frequency of projection (every year? to the  
222 endpoint?)?

223

224 ➤ What are the components (ecological-social-political-economic) within the system?

225

226 ➤ What are the connections and feedbacks (physical, biogeochemical, biotic, social, economic,  
227 political) within the system?

228

229 ➤ What are the inputs and drivers?

230

231 Our project asked "What is the economic, ecological/environmental, political and social context in  
232 which the goals for Lake Wingra will be addressed?" We held a workshop to conduct a systems  
233 analysis to establish a framework for thinking about this overarching question.

234

235 The results of the workshop are summarized in below (Figures 2 and 3, on the following page). The  
236 class decided to focus the scenarios on events occurring within the City of Madison from the  
237 present thorough approximately one generation into the future. Within the City of Madison, we  
238 identified several ecological, social, political, and economic components which are relevant to the  
239 future of Lake Wingra (Figure 2). The list generated was meant to be representative of the types of  
240 components we were concerned with but is not intended to be all-inclusive. Although we set the  
241 boundaries of our focus on the City of Madison, we were also interested in identifying relevant  
242 inputs and drivers of the system that originated outside of the City of Madison (Figure 3). These  
243 external inputs and drivers were placed in nested units of government from Dane County to the  
244 entire globe and include ecological, social, political, and economic factors.

245

Figure 2. Components of the Social-Ecological System of Lake Wingra and their connections. The spatial extent of the system is the City of Madison.

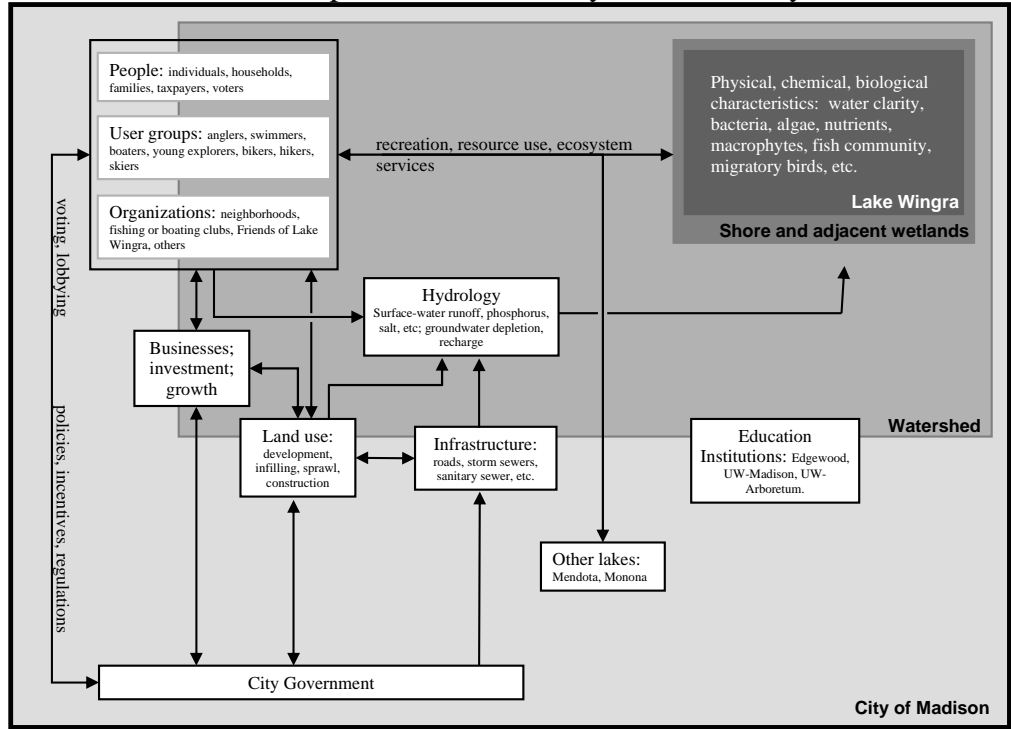
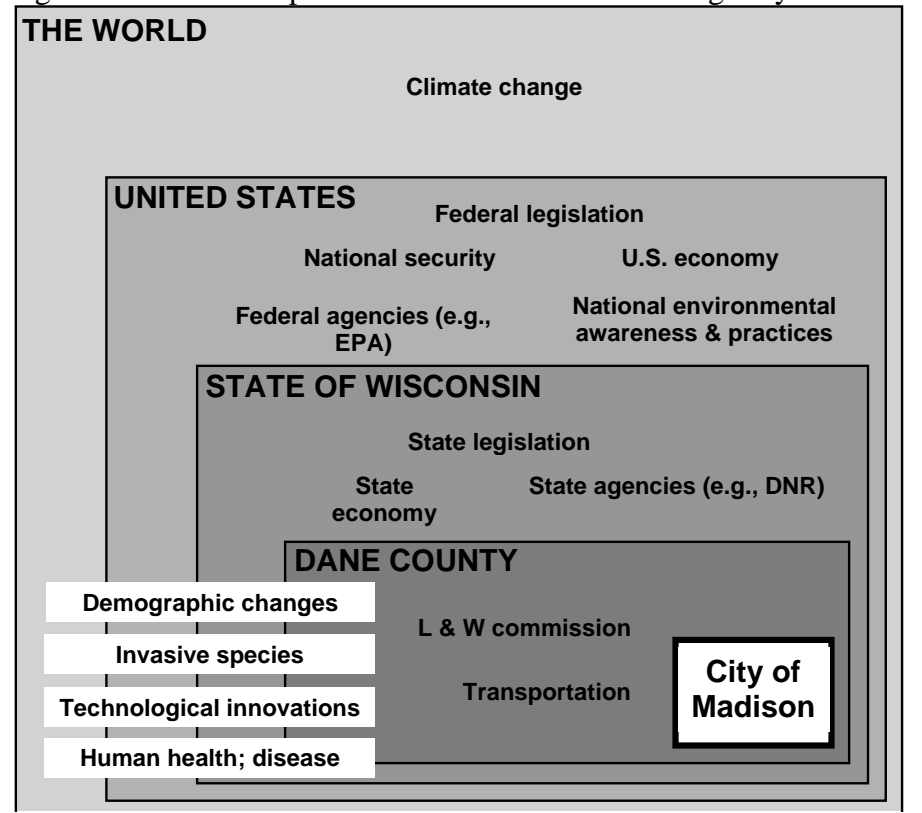


Figure 3. External inputs and drivers to the Lake Wingra System.

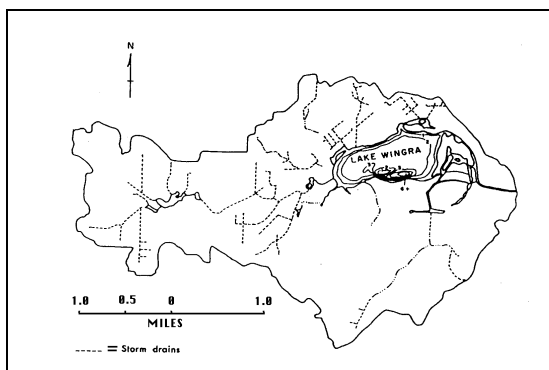


## 292 Current Condition of the Lake and Watershed

293  
 294 Lake Wingra (air photo below) is a small, shallow, eutrophic lake in southern Wisconsin. While  
 295 there are many lakes that fit this description, what makes Wingra unique is that while much of its  
 296 watershed is urban, its shoreline is mostly undeveloped. This combination of characteristics makes  
 297 Wingra a valued community resource – a largely natural refuge in an urban environment. However,  
 298 its vegetated shores only thinly conceal a profoundly altered watershed that exerts continual stress  
 299 on the lake ecosystem.



311  
 312 The Lake Wingra watershed (map below) covers 18 square kilometers in Madison, Wisconsin.  
 313 Approximately 75% of the watershed area is developed, and is mostly residential. Most of the  
 314 undeveloped land is in the University of Wisconsin Arboretum, which includes wetland and forest  
 315 that border the lake to its west and south. Edgewood College and two city parks border the lake to  
 316 its north and east. Most of the watershed drains into a network of storm water pipes. Some of these  
 317 pipes discharge directly into Lake Wingra, but most of them first pass their contents through  
 318 detention ponds.



330 Lake Wingra is a headwater lake, receiving water inputs from direct precipitation, surface runoff,  
 331 and groundwater inflow, in approximately equal proportions. Since the watershed was developed,  
 332 many springs have dried up and the relative contribution of surface runoff has increased, especially  
 333 during rain storms. Compared to pre-settlement conditions, storm water runoff currently carries 10  
 334 times as much phosphorus and 5 times as much sediment to the lake each year. Phosphorus  
 335 concentrations in the lake water are typically 40  $\mu\text{g/L}$ , which scientists consider too high. Summer  
 336 Secchi depth (water clarity) is typically 0.7 m, which means you cannot see your feet if you are  
 337 standing in water more than 2 feet deep. Algae blooms are common and are the primary cause of

338 low water clarity. As a result of street salting, chloride concentrations in the lake are elevated from  
339 5 mg/L (pre-salting) to a current level of 75 mg/L. This increase is big enough to affect plants and  
340 animals in the lake.

341  
342 Some remnants of the original vegetation surrounding Lake Wingra remain, including fens, sedge  
343 meadows, wet meadows and shallow marshes. To varying extents, however, all of these vegetation  
344 communities have been colonized by exotic species, including buckthorn, hybrid cattail, reed canary  
345 grass, and purple loosestrife. Many species of native submerged macrophytes also remain, although  
346 the invasive Eurasian water milfoil is dominant by mass.

347  
348 The sport fish community of Lake Wingra is dominated by bluegill, largemouth bass, and  
349 muskellunge. Musky fishing is very popular because stocking by the DNR keeps their densities  
350 extremely high (four fish per acre). Common carp, an invasive species, are also abundant in the  
351 lake, and are thought to contribute to phosphorus recycling and turbidity problems by rooting  
352 through lake-bottom sediments.

353  
354 Lake Wingra is very popular for recreation. Despite water quality degradation, swimming and  
355 fishing are popular. Motor boats are not allowed on the lake on weekends (and restricted to low  
356 speeds on weekdays), which makes it a popular place for canoeing and sailing. The two parks that  
357 border the lake are popular spots for relaxing and playing sports. During the winter, many people go  
358 ice skating and skiing on the frozen lake.

359  
360 Lake Wingra is valued by the community around it. Financial backing and volunteer contributions  
361 to organizations such as Friends of Lake Wingra are evidence that people want the lake to be better.  
362 Management agencies and research institutions also recognize the potential of Lake Wingra to serve  
363 as a test case for lake and watershed management. Significant effort is being directed toward  
364 mitigating much of the degradation that Wingra has experienced.

### 365 **Four Scenarios**

366  
367  
368 In the following pages, we present four scenarios for the future of Lake Wingra. The four scenarios  
369 are:

- 370  
371 ➤ **Garden State:** A global environmental movement dominates local action
- 372  
373 ➤ **Big Green Brother:** Grassroots interests and government action converge
- 374  
375 ➤ **C-Clear:** Regional politics complicate ecosystem management
- 376  
377 ➤ **Exotic Exchange:** Unexpected invasions of exotic species create new challenges

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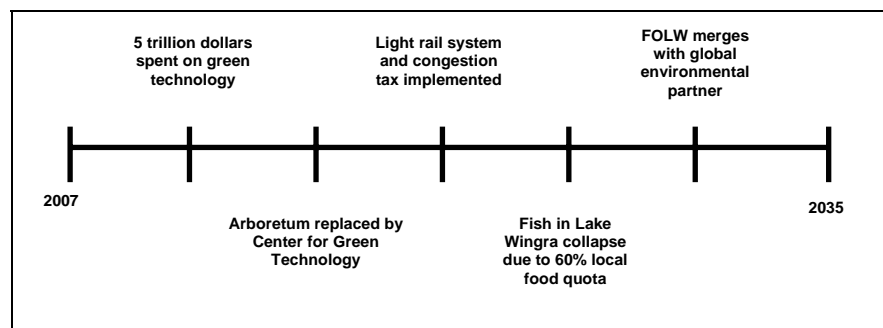
## GardenState

**Overview:** *The year 2035 shows a radically different Lake Wingra watershed than the one we see today. A global movement, reliant on new technology, emerges hell-bent on fixing the environmental mess that only appears to be getting worse. Between 2010 and 2015 over 5 trillion dollars are spent on green technology to mediate the most pressing environmental problems. Madison soccer moms trade in their minivans for hydrogen powered commuter scooters while NASCAR dads lobby their favorite drivers to use sustainably harvested locally grown bio-fuels. From rain gardens to local food production to the carp-a-thon, Lake Wingra followed the lead of the global environmental movement to green their watershed by employing the latest in new technology. Unintended consequences emerge as the population swells, ecosystems are replaced by engineered substitutes, and community groups hand over the reins to multi-national environmental super powers.*

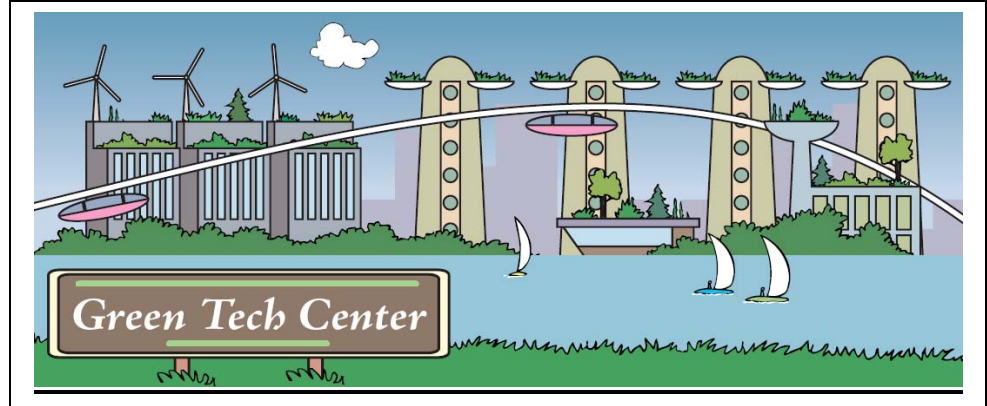
The globally-influenced and technology heavy environmental ethic in Madison led to many sweeping changes in urban design and planning with respect to energy and water. In light of rapid changes in the watershed, the residents lobbied their city and state governments to include the health of the lake and the visions of the many user groups into the ongoing changes. In 2012 policies were enacted to construct prolific rain gardens around the city as well as to replace much of the road surface with permeable blacktop, developed at UW-Madison. The rain gardens not only acted to reduce run-off from streets and buildings, but the street-lined gardens were planted with native prairie plants that were harvested and converted to cellulosic ethanol for use in the municipal fleet. Three times each summer, automated trucks weaved their way around Madison harvesting the vegetation from the curbside gardens. Energy credits were given to homeowners based on the amount of biomass they grew. Rooftops gardens were planted with newly engineered high-yielding strains of summer food crops, as it helped Madison achieve their goal of producing 60% of all their food from within a 300-mile radius.

By 2016, the Arboretum was overrun with invasive species. UW used proceeds from leased real estate to fund building of the Wisconsin Center for Green Technology on the site of the old Arboretum buildings. Madison relied on the output of the center to reduce their environmental impact as the city continued to grow. Energy and transportation costs continued to rise making it more affordable to live in the city. Green high rises that lined Monroe street and other downtown thoroughfares were built at record speeds. Though the permeable roads bolstered groundwater supplies, the roads could not withstand heavy use. Spurred by poor road conditions and high gas prices, 2018 marked the introduction of a light rail system in concert with the enactment of the congestion tax meant to keep motorists off roads within the city limits.

In 2019, all fish advisories in the Madison lakes were lifted as pollutants in runoff dropped to negligible levels. In 2020, the first-annual carp-a-



430 thon mobilized  
 431 disparate groups  
 432 from recreational  
 433 fishers to folks who  
 434 consider catching  
 435 carp as a way of life.  
 436 Nearby businesses  
 437 showed their support  
 438 by serving the  
 439 captured carp during  
 440 the Friday night fish  
 441 fry and by providing



442 volunteers with awards for the most carp caught. The citywide effort landed 6,300 tons of the pesky  
 443 fish in the first year, prompting even more intensive effort. Within a few years catches were much  
 444 smaller as common carp were nearly eliminated. With the carp gone, water quality improved and  
 445 native species became more abundant in the lake.

446  
 447 While many of the goals laid out for the Lake Wingra watershed were accomplished, some of the  
 448 decisions made didn't come without compromise. Even with the most advanced lighting  
 449 technology, the doubling of population in the Wingra watershed forced it to give up its "dark sky"  
 450 certification and with that the loss of the largest urban astronomy conference in the United States.  
 451 Yet, Madison was known as "Sustainability Valley" for its leadership in technological solutions to  
 452 environmental problems. Conferences at the Center for Green Technology drew eco-friendly  
 453 scientists and entrepreneurs from around the world.

454  
 455 2025 saw a collapse of most of the major fish species in the lake as the Fish for Madison Co-op (a  
 456 cooperative formed between local grocers and recreational and subsistence fishers) utilized lake  
 457 resources to meet the 60% local food quota. The lake was then converted into a catch-release  
 458 fishery until populations could stabilize, but continued to suffer from poaching from members of the  
 459 community who successfully evaded the Fish-landing Interception and Notification System  
 460 (F.I.N.S.). When the fishery did not recover the Wisconsin Center for Green Technology gained  
 461 permission from the city to use experimental whole-ecosystem aquaculture in Lake Wingra to  
 462 continue supplying the city with locally grown food. Fishes bred for high protein content were  
 463 stocked and reared in the lake with efforts to mimic the natural populations that had previously  
 464 existed.

465  
 466 Increases in recreational boaters led to the construction of a three-story canoe livery that blocked the  
 467 views of some of the high-value real estate near Vilas Ave., after which many wealthy residents  
 468 withdrew their support for further environmentally minded changes in the area. By 2033 the voice  
 469 of the FOLW was muted by community members with greater political influence and bigger  
 470 budgets. In order to play with the big dogs, FOLW became a subsidiary to a global environmental  
 471 partner with very deep pockets, Green4Life. The 4 billion member organization lent oversight to  
 472 future changes in the watershed. In her 2035 State of the City address the mayor questioned  
 473 whether Green4Life's vision for the city fit with the evolving Madison to which they were still  
 474 learning to adapt.

## 475 **Big Green Brother**

476

477 **Overview:** *In this scenario, positive changes are brought about by efforts to link grassroots*  
 478 *interests and government action at the local level. Community members aim to improve shoreline*  
 479 *habitat, curb sediment in runoff and recharge groundwater supplies. Projects are successfully*  
 480 *implemented through coordinated funding and project management led by local government. In*  
 481 *efforts to allow safe access to Lake Wingra for all users, a number of city and county ordinances*  
 482 *are instated. The trend toward top down management of local resources leaves a bad taste of big*  
 483 *government in residents' mouths. When a drought hits the Madison area government officials*  
 484 *become focused on mitigating effects of the drought and lose sight of goals for the Lake Wingra*  
 485 *ecosystem.*

486

487 In 2010, the Friends of Lake Wingra were successful in lobbying the Madison government to  
 488 implement changes in the property tax structure which created incentives for homeowners to plant  
 489 "rain gardens" that filter water that runs off their rooftops. What were once a novelty became  
 490 commonplace. The quality of the storm water runoff was also improved through changes in road  
 491 maintenance, which restricted salt application to bus routes. These changes in storm water  
 492 management led to less sediment and salt entering the lake.

493

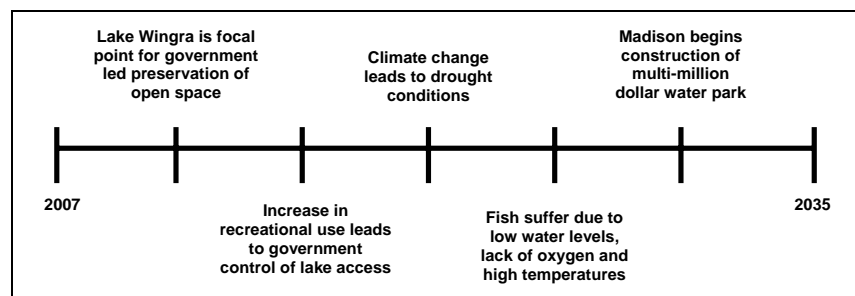
494 Lake Wingra and the neighboring Vilas Zoo and U.W. Arboretum were a focal part of the city's  
 495 investment in preserving open space during 2010s and 2020s. Tens of millions of city tax dollars  
 496 and state grants were leveraged by local leaders and directed toward improving water quality  
 497 through a combination of fisheries and shoreline habitat management projects. Following the  
 498 success of the Odana infiltration field project, the county supported plans to expand and build more  
 499 infiltration fields across Dane County including one in cooperation with the Glenway Golf Course.  
 500 Local plans were efficiently implemented through coordinated efforts at city, county, and state  
 501 government levels.

502

503 By 2022 the improvements in the Lake Wingra watershed were mirrored by an increase in  
 504 recreational use of the lake. Recreational fisherman and rowers often vied for use of the park  
 505 during the calm morning and evening hours. The Friends of Lake Wingra mediated a public  
 506 hearing to resolve issues between lake users. After much public debate and some hard feelings on  
 507 both sides, the city mandated a compromise by limiting access to the lake for rowing on odd  
 508 calendar days and fishing on even. There were mixed feelings about the outcome of the civic  
 509 process. "What was once viewed as an opportunity to fund and implement grassroots initiatives is  
 510 now seen as big government," reflected lifelong resident and city alder Jamie Clearwater.

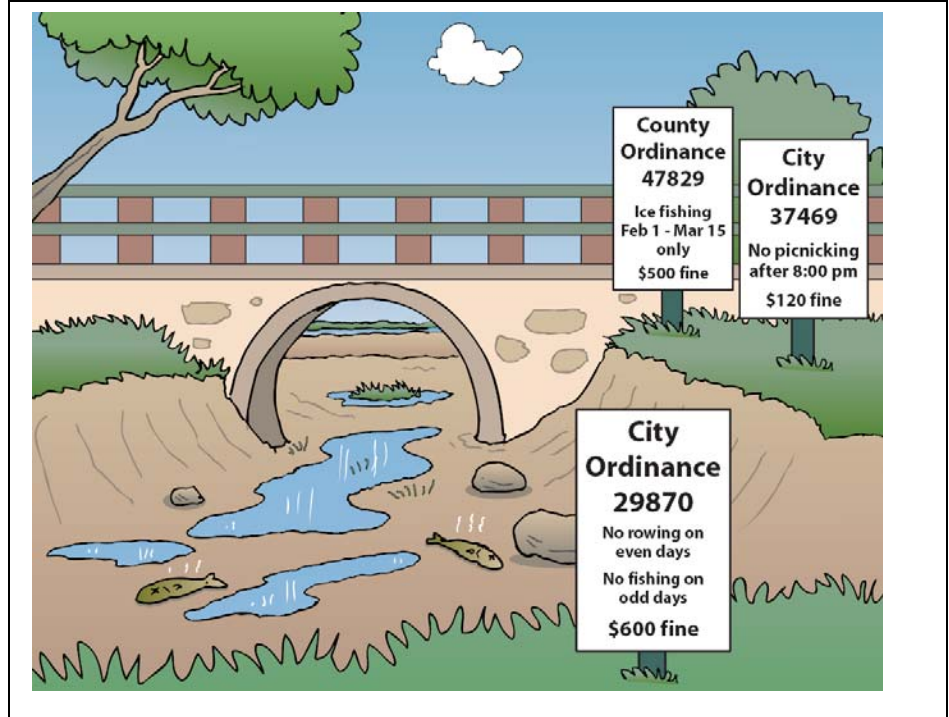
511

512 In 2029 climate change began to hit home. The ice fishing season was kept short by city ordinances  
 513 that dictated when and where  
 514 Madison residents could fish  
 515 after a record number of  
 516 people broke through thin ice.  
 517 The rain gardens became  
 518 superfluous as Dane County  
 519 entered its 8<sup>th</sup> summer of  
 520 below average rainfall. When



521 the drought was  
 522 unbroken by 2033, the  
 523 County Lakes and  
 524 Watershed Commission,  
 525 supported by legislation  
 526 in the federal farm bill,  
 527 approved the extraction  
 528 of limited amounts of  
 529 surface waters for use in  
 530 irrigation. Water from  
 531 the Yahara Lakes was  
 532 pumped to nearby fields  
 533 to support local growers.

534  
 535 Lake Wingra was hit  
 536 especially hard by  
 537 decreased water input.  
 538 The marshes in the  
 539 nearby Arboretum were  
 540 dry through most of the



541 summer leading waterfowl and other wildlife to find another place to call home. The water levels in  
 542 the lake fell by nearly three feet exposing a ring of muddy land between Vilas beach and the waters  
 543 of the lake. The summer temperatures in the lake increased leading to high rates of decomposition  
 544 of organic material and frequent deoxygenation of the bottom waters of the lake. The warm  
 545 temperatures and low oxygen levels led to declines in the largemouth bass, yellow perch and black  
 546 crappie populations in the lake. The unappealing mudflats and deterioration of the fishery led to a  
 547 dramatic decline in recreational use of Lake Wingra. Residents found a substitute for the lake when  
 548 the new city-subsidized water park was built using water mined from a deep aquifer. To top the  
 549 community pool, the water recreation park had water slides, a lazy river and a fishing pond where  
 550 Madisonians could catch all their favorite sport fish. The mudflats and ephemeral pools of water  
 551 surrounding Lake Wingra were worse than an eyesore. They provided breeding grounds for  
 552 mosquitoes and residents concerned about insect-borne diseases began petitioning for pest  
 553 eradication measures to be taken on the shorelines.

554 .  
 555 By 2035 the voices of grassroots organizations lobbying for the Lake Wingra ecosystem fell on deaf  
 556 ears when city and county attention became focused on dealing with the effects of persistent  
 557 drought conditions, preserving Wisconsin's agricultural tradition, and providing safe and healthy  
 558 recreational activities for Madison residents.

559

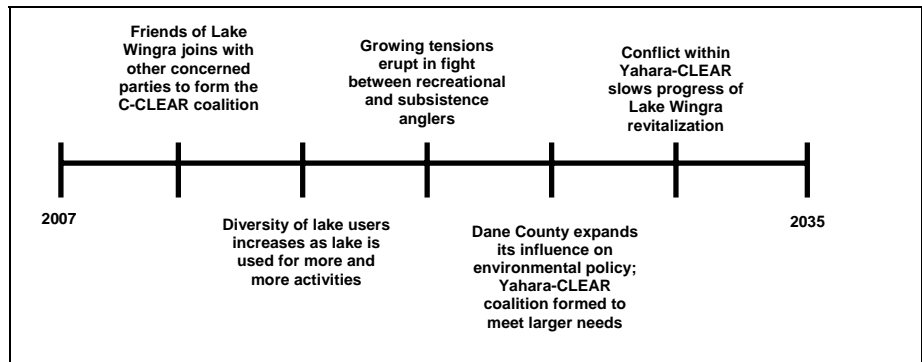
560 **C-CLEAR**

561  
 562 **Overview:** *This story attempts to explore positive actions, unintended consequences, and potential*  
 563 *limitations toward fulfilling ecological and recreational goals for Lake Wingra. Following existing*  
 564 *trends, better coordinated environmental groups form a coalition in 2015 to leverage resources to*  
 565 *meet their goals. Up to 2025, the coalition works with city leaders until the larger Dane County*  
 566 *unexpectedly works against coalition and city goals. To meet this challenge, the coalition organizes*  
 567 *across the county but political gridlock over environmental issues ensues. Lake ecological health*  
 568 *improves slowly and the coalition must make difficult and uncertain decisions about its goals.*  
 569

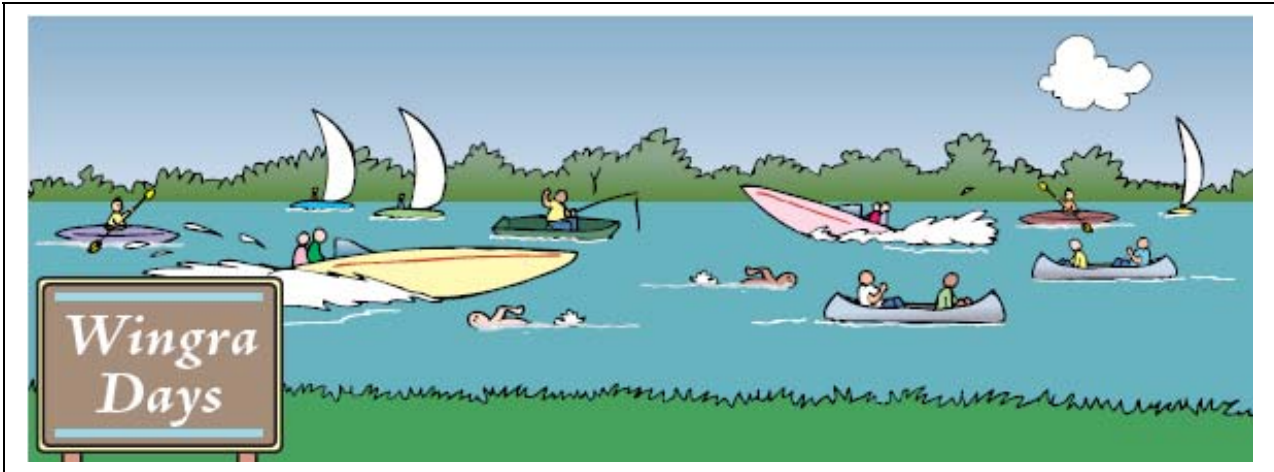
570 Lake Wingra meant many things to the local urban community, whether it was taking a refreshing  
 571 swim on a balmy summer day, running through the arboretum on your lunch break, or fishing for a  
 572 tasty treat. The lake was a premier musky fishing spot as profiled by the local television show "The  
 573 Fishing Guide," attracting many fishermen to the lake on weekends. At the same time, lake fish  
 574 were an important food source for local subsistence fishermen. "Eatin' carp is better than the same  
 575 old hot dogs or mac'n cheese" declared single mother Sandy Blanco. By 2015, the Friends of Lake  
 576 Wingra had expanded to include a refreshing mix of residents, non-profit groups, government  
 577 agencies, and educational institutions in their mission to protect and improve the health of the lake.  
 578 Together, the Community Coalition for Lake Ecology and Recreation (C-CLEAR) experienced  
 579 their first coordinated triumph as they pressured Madison into adopting clean-up efforts to improve  
 580 water quality. C-CLEAR continued to build momentum as evidenced by the Evjue Charitable Trust  
 581 grant awarded to expand shoreline restoration.  
 582

583 Chairperson Helen Carter explained, "It's hard to believe that just ten years ago many of our  
 584 member groups didn't work together. Coming together focused our efforts and generated extra  
 585 resources. We're in the process of hiring our third full time staff member." Extra support came  
 586 from educational institutions that capitalized on large participatory research grants and a growing  
 587 emphasis on citizen ecological monitoring by government agencies. Board member Bob Koch was  
 588 cautiously optimistic about the future: "Monitoring efforts on Wingra have shown a steady increase  
 589 in water clarity over the past five years. We're expanding our programs to include everything from  
 590 encouraging better storm water management in the larger watershed to working on a dark sky  
 591 preserve."  
 592

593 Paralleling demographic changes across the city from 2015-2025, the diversity of lake users and  
 594 activities steadily increased. The aromas of ethnic food barbeques and the sounds of multiple  
 595 languages and Midwestern accents were commonly heard around Wingra. Low-impact aqua  
 596 jogging classes for elderly  
 597 adults were consistently  
 598 oversubscribed. Lake  
 599 users groups were cordial  
 600 to each other but tended to  
 601 stay within their own  
 602 social circles. But growing  
 603 separation between  
 604 different ethnic and  
 605 socioeconomic user groups



606 began to foster fear and misunderstanding. Social tensions boiled to the surface when a boating  
 607 accident escalated into a fight between a group of recreational anglers and several local fisher  
 608 people. Although there were conflicting accounts, most witnesses said that a racial slur used after  
 609 the accident instigated the violence. C-CLEAR members disturbed by the events created elderly,  
 610 multi-lingual, and disability friendly outreach and education programs to make the lake accessible  
 611 to all residents.



612  
 613 Ethanol-driven development and population growth across Dane County was notably higher than in  
 614 Madison. By 2025 Dane County was in open conflict with Madison environmental initiatives and  
 615 political gridlock ensued. C-CLEAR responded by expanding its coalition to include Dane County  
 616 and Yahara Watershed groups, culminating in the broader Yahara-CLEAR organization or Y-  
 617 CLEAR. The last board member to approve the plan expressed mixed feelings; “We need a bigger  
 618 coalition to address bigger problems; but are we diverting too much attention from local lakes?”  
 619

620 The expanded coalition soon began to face mounting problems within the group. Most of Y-  
 621 CLEAR’s efforts were directed toward challenging county initiatives. Many Madison members  
 622 voiced concerns over the shift in priorities away from local waters and cynics referred to “WHY-  
 623 CLEAR?”. Conflicts over policy led several disenfranchised members to leave the coalition in order  
 624 to pursue more local goals. Self-organization and leadership became less prevalent in the coalition  
 625 and despite making steps toward improving land use in the Yahara watershed, Y-CLEAR was  
 626 encumbered by stagnation caused by inconsistent goals within the group.  
 627

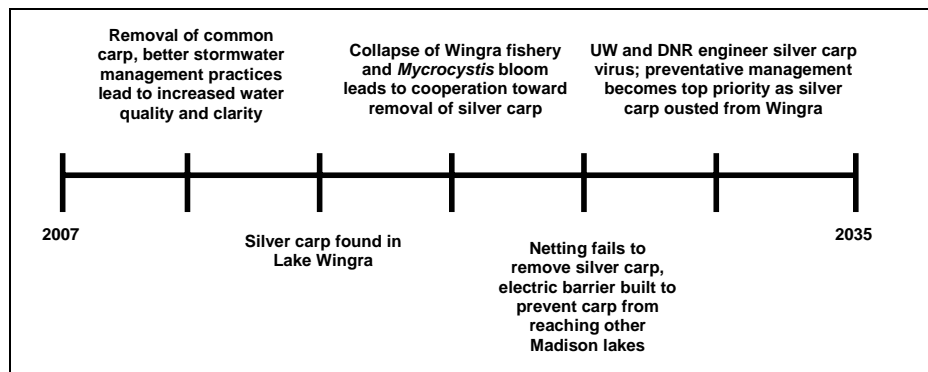
628 Lake Wingra’s ecological health improved slowly up until 2035 but not nearly as quickly as many  
 629 hoped; “After all that fuss, I thought the lake would’a looked more like it did when I took my first  
 630 swimming lesson” lamented Stan Stevens. The harm from decades of nutrient overload and  
 631 harmful invasive species could not be overcome quickly. Despite numerous challenges and  
 632 setbacks, the Y-CLEAR organization celebrated the progress made over the past 25 years. “We’ve  
 633 come a long way,” reflected Helen Carter at a banquet honoring board members for 20 years of  
 634 distinguished service, “What kept me going through all the late nights and cloudy days has always  
 635 been the energy of new members and the bright young faces of kids playing in Lake Wingra.”

## 636 Exotic Exchange

637  
 638 **Overview:** *Fluxes of exotic species provide challenges and opportunities for those who manage and*  
 639 *care about Lake Wingra. Initially, a substantial reduction in the common carp population typifies*  
 640 *general progress toward meeting community goals for the lake. However, an unexpected invasion*  
 641 *by silver carp not only reverses previous gains, but creates new conflict among users, as well as*  
 642 *new disruptions in the lake’s ecology and in its recreational appeal. Efforts to manage the new*  
 643 *invader with existing approaches are unsuccessful. Eventually, collaborative research provides a*  
 644 *technological solution that eliminates the carp. The community again rallies around the lake and*  
 645 *begins to take a more preventive stance toward invasives. Fish management re-orientes around*  
 646 *diverse interests.*

647  
 648 In the late 2000s and early 2010s, Lake Wingra and its surroundings continue along much  
 649 the same path that characterized the previous decade. The watershed experienced some infill  
 650 residential and commercial redevelopment, some of which increased population density. However,  
 651 increasingly strict city regulations governing construction-site runoff and erosion control mitigated  
 652 the effects of these disturbances on the lake. At the same time, record numbers of existing homes  
 653 and businesses built rain gardens and other on-site storm water management practices aimed at  
 654 increasing rainfall infiltration. As a consequence, pollutant loads and runoff volumes to the lake  
 655 were reduced and a few springs that had dried up in the late 1900s started flowing again. Despite  
 656 objections from those who feared adverse impact on sport fish, densities of common carp in the lake  
 657 were drastically reduced by netting during their spring spawning aggregations in the Vilas Park  
 658 lagoon. Common carp feed by filtering through soft sediments, stirring particles into the water  
 659 column in the process. As populations of common carp declined, the lake experienced increased  
 660 water clarity that led to a resurgence of native aquatic plants in near-shore areas, with some shallow  
 661 patches of lake reverting back to marshland. Fishing improvements and better swimming  
 662 conditions led to increased recreational use and the lake more resembled its pre-settlement state  
 663 than at anytime since the mid-1800s.

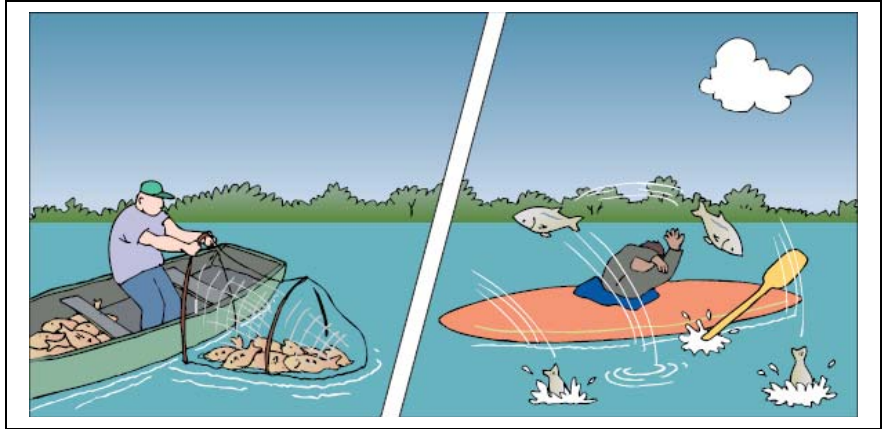
664  
 665 In 2017, several silver carp, an invasive fish originally from Asia, were observed by boaters  
 666 in Lake Wingra. One of the boaters, Andy Ryland, recognized the fish from a video clip he’d seen  
 667 on the local news, saying “[the fish] jumped a clear six feet out of the water as we drove by!” This  
 668 species had been spreading throughout the Mississippi basin, but had not previously been detected  
 669 in the Yahara watershed. The sudden geographical jump led the DNR to conclude that the fish had  
 670 been intentionally introduced. This idea gained support when large numbers of lower-income  
 671 anglers began harvesting  
 672 silver carp for food. By  
 673 2021, the silver carp had  
 674 become the most  
 675 abundant species (by  
 676 weight) in the lake. In  
 677 contrast to common carp,  
 678 silver carp feed by  
 679 filtering massive  
 680 quantities of  
 681 phytoplankton and



682 zooplankton near the water's surface. The reduction in plankton populations led to the dramatic  
 683 decline of native zooplanktivorous fish, which led to poor growth and survival of predatory game  
 684 fish, including bass and musky. Though silver carp can process many species of phytoplankton, the  
 685 toxic blue-green algae *Mycrocystis* passes through the gut unharmed. A *Mycrocystis* bloom in 2022  
 686 resulted in a dramatic reversal of water clarity and raised safety concerns after a local dog died from  
 687 ingesting microcystin toxin; swimming in the lake became a thing of the past. Outcry from Wingra  
 688 residents and from sport fishermen led the two previously quarrelling factions to put their  
 689 differences aside in the common goal of ousting silver carp from the lake.

690

691 To prevent silver carp  
 692 from invading the rest of the  
 693 Yahara lakes, an electric fish  
 694 barrier was constructed at the  
 695 outlet of Lake Wingra. The  
 696 barrier also prevented musky  
 697 entering the lake and caused  
 698 people to avoid the area out of  
 699 fear of being shocked, despite  
 700 assurances by the DNR of its  
 701 safety. Neighborhood resident  
 702 Donna Schultz echoed the



703 sentiments of many parents when she said “Why should this fish keep my kids from playing by the  
 704 lake – it will probably get to Lake Monona some other way anyway.” Massive netting efforts  
 705 through the 2020s attempted to reduce the numbers of silver carp, but were not nearly as successful  
 706 as with the common carp. Social conflict emerged between sustenance-fishers and sport-fishers as a  
 707 result of the changes in the lake, bringing out underlying sentiments of blame and resentment of  
 708 privilege. Boating on the lake became unpopular after several people were injured by leaping silver  
 709 carp. The overall ecological and recreational deterioration of the lake along with the large amount  
 710 of money spent on damage control led many people to see Wingra as a lost cause. Public funds for  
 711 ecosystem management were diverted to other lakes. From the public's perspective, Wingra had  
 712 become useful only for *de facto* aquaculture of silver carp.

713

714 In the early 2030s, funds raised by a resurgent Friends of Lake Wingra supported a  
 715 collaborative research effort by UW and the DNR that developed a method for interrupting the  
 716 larval development of silver carp. After some initial trials in which large numbers of native larval  
 717 fish were killed, a highly specific virus was genetically engineered and introduced into Lake  
 718 Wingra. Silver carp were eliminated from Wingra in 2033, and the method was quickly applied  
 719 elsewhere to great success. Friends of Lake Wingra chair Milo Vander Zanden exclaimed in 2035,  
 720 “The community is once again rallying around Lake Wingra!” Prevention of further species  
 721 invasions became a priority management approach: a policy prohibiting personal boat use on  
 722 Wingra passed in 2035 to prevent boat-transfer of invasive species. Conflicts between user-groups  
 723 still exist, but are openly discussed with greater ease. A compromise between food and sport fishing  
 724 interests is being sought in deciding what kinds of fish to restock, and Wingra associated groups  
 725 focus on heading off the potential for another intentional species introduction.

726

727 **Discussion Questions**

728  
 729 The scenarios are not an endpoint, and they will never be "finished". They are for stimulating  
 730 discussion about the future of Lake Wingra. For example, readers might consider questions like  
 731 these.  
 732  
 733 ➤ Do any scenarios seem particularly likely or unlikely? Why?  
 734  
 735 ➤ Do any scenarios seem particularly attractive or unattractive? Why?  
 736  
 737 ➤ What would you do if you lived in each scenario?  
 738  
 739 ➤ What can you do now to make Lake Wingra a better resource for you and your neighbors?  
 740  
 741 Many other questions can and should be asked about the future of Lake Wingra. The current state of  
 742 the lake is what it is; the future is yours to change.  
 743  
 744

745 **What's Next?**

746  
 747 In coming weeks, we will make some decisions about continuation of the scenarios process.  
 748 Further information about next steps will be available on the web sites of Friends of Lake Wingra  
 749 (<http://lakewingra.org>) and the North Temperate Lakes Long-Term Ecological Research site  
 750 (<http://lter.limnology.wisc.edu>).  
 751  
 752

753 **References and Suggestions for Further Reading**

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 765

766 **Appendix 1: Stakeholder who contributed to the development of the scenarios**

767

768

769 *FOLW representatives who participated in the weekly seminar sessions*

770

771 ♦ Anne Forbes

772 ♦ Jim Lorman

773 ♦ David Liebl

774

775

776 *Stakeholders who participated in the Wingra Scenarios Workshop on March 2, 2007*

777

778 ♦ Brenda Baker, Madison Childrens Museum

779 ♦ Matt Diebl, FOLW Board

780 ♦ Daniel Einstein, UW facilities planning and management

781 ♦ Anne Forbes, FOLW Board

782 ♦ John Nicol, Environmental engineer and family therapist, watershed resident, FOLW Advisor

783 ♦ John Pohlman, DNR land specialist, watershed resident

784 ♦ Rebecca Power, UW Extension, Great Lakes Regional Water Quality liaison, former River

785 Alliance of WI board member and chair, watershed resident

786

787

788 *Stakeholders who participated in the scenario feedback interviews*

789

790 ♦ Doug Bach, Dane County Lakes & Watershed Commission

791 ♦ Kevin Connors, Dane County Lakes & Watershed Commission

792 ♦ Craig Eversoll, Musky Fishing Group (Muskie Inc.)

793 ♦ Steve Glass, UW Arboretum

794 ♦ Dick Lathrop, Wisconsin Department of Natural Resources

795 ♦ Tyler Leeper, Local Business (Wingra Canoe and Sailing Center)

796 ♦ Jim Lorman, Dane County Lakes & Watershed Commission

797 ♦ Ken Potter, UW-Madison Engineering

798 ♦ Tommye Schneider, City of Madison Public Health Department

799 ♦ Kirsti Sorsa, City of Madison Public Health Department

800 ♦ Kurt Welke, Wisconsin Department of Natural Resources

801

802