

liming cost-benefit analysis reported under Economic Benefits (V.B.3.), but instead illustrates the limited size of the current liming program when compared to the great number of waters lost or impaired due to acidification in NYS.

In recent years, DEC's Region 6 has utilized up to 20 tons of agricultural lime per year on liming projects. Lime is usually bought locally. At an average price of \$35 per ton, this purchase brings approximately \$700 per year into local business economies, thus impacting their growth and stability. Statewide, the growth inducing aspect of the pond liming program are insignificant.

#### X. EFFECTS ON USE AND CONSERVATION OF ENERGY RESOURCES

The use of energy results directly from conducting pond liming operations, and indirectly as a result of increased public use of the limed ponds. Involved is the transportation of workers to and from the site, and the energy consumed by the public traveling to and from the particular ponds.

Liming projects utilize energy involving various size vehicles and equipment, including snowmobiles, small outboard motor equipped boats, small and large trucks, and for remote projects, a helicopter or fixed wing aircraft. Overall impacts of pond liming on the use and conservation of energy are insignificant.

#### XI. ALTERNATIVES TO THE PROPOSED PROGRAM

##### A. Control Emissions

The control of acid deposition causing emissions may be considered by some to be an alternative to the proposed liming program. However, the DEC is currently pushing for effective emissions controls and will continue to do so regardless of the status of the liming program. As has been mentioned in other sections of this EIS, the only viable solution to the acid deposition problem is emissions controls, and liming is not viewed by the DEC as a viable alternative to reduced emissions. The DEC was instrumental in the passage of the State Acid Deposition Control Act of 1984 and has prepared environmental impact statements for the control of sulfur dioxide and nitrous oxides. Emissions controls are viewed as a high priority and will not be affected by the implementation of the proposed revised liming policy.

When federal legislation is finally passed to control acidic deposition by reducing emissions on a national level, the probable result is that emitters will have a number of years to actually implement the controls. As was the case with the New York State emissions reduction plan, the emitters may also be granted several phases to gradually reduce emissions. There will therefore be a lag period of possibly 5-10 years before reductions in emissions are actually required.

In addition to the time lag to actually implement air pollution controls is the fact that the natural environment requires a number of years to recover from the impacts of acidic deposition. Although indications and predictions are that the response of lakes to the reduced deposition levels may be quite fast, the probable situation is that there will be a range in response times from fast to slow. Lakes which have high flushing rates may respond more quickly to emissions controls than lakes with slow flushing rates.

In summary the proposed liming policy and program are viewed as quite separate topics from the control of acidic emissions. The liming of certain waters may still be necessary for a number of years after federal acid rain legislation is passed because of the lag time in implementing the legislation and the lag in response from the natural environment. Emissions controls are essential for the protection of a healthy environment and are not considered as a viable alternative to the proposed liming policy.

#### B. Do Not Lime Any Waters

The objective of DEC liming projects is to either protect a unique fish population from environmental degradation or to restore a viable fish population/ecosystem to a pond which became acidic due to the impacts of acidic deposition. If the no liming alternative was selected and the DEC liming program was eliminated the result would have considerable negative impacts on the environment. A small savings in DEC staff time and funds would be realized by such a decision, but the savings do not appear to justify the negative impacts on the resource.

The current DEC liming program is relatively small and includes 32 Adirondack waters which are valuable as a resource for a number of reasons. Several waters are broodstock waters for unique heritage strains of brook trout. The loss of these waters to acidic deposition has been prevented by protective liming, and ending the DEC liming program would subject these waters to acidification and the possible loss of these valuable strains of fish. Whether or not these fish could be netted and transferred to more favorable habitats is questionable and less desirable than managing their home waters.

By eliminating the DEC liming program the waters which have been limed to restore viable sport fisheries resources and healthy aquatic habitats, would gradually reacidify. In the process of reacidification acid sensitive species which have become established would be lost from the ecosystem, species diversity would be reduced, and the overall value of the resource would be diminished. The recreational fisheries which have been established with the liming program would also be lost as the systems reacidified. In addition, wildlife species and other acid sensitive organisms have benefited from the DEC liming program, and eliminating the program would reduce the amount of suitable habitat for loons, osprey, eagles, mink, otter, ducks, crayfish, mayflies, and numerous other organisms. Because of these environmental impacts of discontinuing any DEC liming, this alternative is not considered to be an acceptable option.

### C. Lime All Acidified Waters

The liming of all acidified waters in the state would be an enormous undertaking on the part of DEC and would result in a high percentage of unsuccessful treatments. Logistically such an effort would be complicated by a lack of DEC staff time and funding to adequately monitor and carry out such a program. If the ALSC data (ALSC 1987) are extrapolated to the entire Adirondack region approximately 700 waters would be considered acidic, with pH levels equal to or less than 5.0. If a pH criteria of less than 5.7 were used far more lakes and ponds would be included. If all acid impacted streams were included in the program the logistical problems would be compounded. Hundreds of miles of streams would qualify for treatment and would require lime dosing equipment and frequent deliveries of lime with resultant wide-spread intrusion.

As is discussed in several sections of this EIS a high percentage of the acidic Adirondack lakes (about 75%) have flushing rates greater than two times per year. These waters, if limed using traditional methods, would reacidify rapidly and result in an ineffective treatment. Treating these high flushing rate waters as streams would require the installation of dosing devices which could continually add lime to the system. These dosing devices have been used in Scandinavia and several streams in the U.S. but have not been sufficiently tested in climates where high volumes of snowmelt water and ice jams can significantly alter the flow regimes of streams. An additional complicating factor is the need for road access to the stream dosing devices in order to supply the doser with large quantities of lime. Many acidic waters are located in wilderness areas where such access is not allowed according to the State Land Master Plan.

Watershed liming has been suggested as a means of more effectively liming lakes with high flushing rates. However, the impacts and actual effectiveness of this approach have not been adequately tested. Application rates, application methods, effects on terrestrial biota, and duration of effective treatment are all topics of concern.

The liming of all acidified waters could also include naturally acidic bog waters. These ecosystems support a community of unique plants and animals which are adapted to life in this naturally acidic environment. These systems should not be limed or otherwise disturbed because they are a unique and valuable part of the natural environment.

The liming of all acidified waters would result in logistical problems, ineffective treatments, and possibly adverse impacts. This alternative is therefore not considered to be an acceptable option. A more moderate approach including criteria for the selection of good liming candidates is more advisable.

D. Lime Only Lakes Critical to Survival of a Unique Strain of Fish

The current DEC liming program includes two lakes, Horn Lake and Tamarack Pond, which are treated specifically to protect the unique strains of brook trout present in these waters. The number of possible candidate waters that fit this criterion is very limited. This alternative would therefore restrict the liming program to these two waters plus several others which may qualify. This alternative would not allow retreatment of waters in the current program where fisheries have been restored or in order to restore additional acidified waters. This alternative is therefore very similar to the no liming alternative. The environmental impacts of this alternative would be considerable, and the DEC would only save a small amount of staff time and funds.

If the only lakes continued in the program were the two with unique strains of fish (plus possibly several others), the other 30 waters currently in the program would gradually reacidify. The recreational fisheries in these waters and acid sensitive plants and animals which have become established would be lost as the water quality became more acidic. Wildlife associated with the limed water would also be forced to move to more favorable habitats. Because of the adverse environmental impacts of allowing these waters to reacidify and the need for fisheries managers to be able to manage fisheries in acid impacted waters, it is not advisable to limit the liming program to only waters with unique strains of fish.

E. Lime Only Lakes Critical to Survival of Threatened or Endangered Fish Species

Using the fish distribution maps of Smith (1985) it appears that the only threatened or endangered fish presently found in areas sensitive to acidic deposition is the round whitefish (Prosopium cylindraceum). As was discussed previously West Canada Lake is the only public water with a pH less than 6.0 which contains round whitefish, and may be considered as a liming candidate. It is not known what the impact of acidic deposition and lake acidification have been on round whitefish populations, and no waters are presently being limed to protect threatened or endangered fish species. The effect of implementing this alternative would therefore be to replace the current program with one new lake, West Canada Lake. Because of the environmental impacts of discontinuing liming the 32 waters currently in the program, this alternative is not considered to be an acceptable option.

F. Lime Only Waters With Potential for Providing High Use Fisheries

This alternative may include as many as half of the waters currently in the DEC liming program, depending on how "high use fishery is defined. Ponds which are easily accessible to fishermen and which are limed and stocked, generally would be expected to receive a considerable amount of fishing pressure. Ponds located near

state campsites or near villages would certainly receive more fishing pressure than remote ponds.

The remaining waters in the DEC liming program which would not be limed under this alternative provide either moderate use fisheries or are limed to protect unique strains of brook trout. The value of the heritage strains of brook trout has been discussed above, and eliminating these waters from the liming program would mean the irreplaceable loss of these valuable fish. Similarly, discontinuing liming in the remaining waters which do not qualify as high use fisheries would mean a loss of viable fisheries resources and associated biota as these lakes reacidify. This adverse impact appears greater than the minimal savings in DEC staff time and funds which would be realized.

It is important to note that DEC fisheries managers have the responsibility for managing more than high use fisheries. In the Adirondacks in particular many remote waters have become acidified because of acidic deposition, and there is a potential for restoring or maintaining a certain limited number of these waters so that they can support aquatic life. These waters may only receive moderate use, and would be expected to provide a valuable recreational fishery for those willing to hike to the pond. They would also provide a habitat more suitable for wildlife and acid sensitive biota. The overall character of the resource and quality of the region's fishing would be improved by the liming of selected ponds which may not qualify as high use fisheries. Because of these factors and the environmental impacts of discontinuing liming in a number of waters, it is not advisable for the DEC to limit its liming program to only high use fisheries.

G. Lime Only Lakes Critical to Survival of Unique Strains of Fish Threatened or Endangered Fish Species or Lakes With Potential for High Use Fisheries

This alternative is very similar in effect to the alternative of liming only waters with potential for high use fisheries. Approximately half of the waters in the current program plus Horn Lake and Tamarack Pond and several others could be limed under this alternative. Although this alternative would include waters which may be found to contain unique strains or threatened or endangered fish species, it also would exclude waters which are currently limed to restore or maintain a moderate use fishery. As discussed in the previous sections discontinuing liming of waters currently in the program would mean that these waters would be allowed to reacidify and have detrimental impacts on the ecosystem.

Also as we discussed previously the DEC has a responsibility to manage more than just high use fisheries. The DEC considers wilderness waters, for example, to be very high value resources and this is discussed in detail in Section II.D.2 of this EIS and also in a draft DEC Memorandum from Commissioner Jorling (see Appendix B). Managing these waters and other moderate use waters will be consistent with Adirondack State Land Master Plan guidelines and with the appropriate Unit Management Plans.

It is also important to emphasize that the liming of waters with moderate use fisheries results in beneficial impacts on the whole aquatic ecosystem. The liming of these selected waters either for high use or moderate use fisheries would help to reverse some of the environmental damage caused by acidic deposition. To limit these restoration efforts to only high use fisheries would mean that many impacted waters could not be limed and would continue to be acidic, inhabited by a few acid resistant species. A more advisable approach is to lime a limited number of these waters because of the beneficial impacts of restoring a more natural water chemistry and aquatic ecosystem.

H. Do Not Lime Any Waters in Wilderness Areas Except Waters Critical to Survival of a Unique Strain of Fish or Threatened or Endangered Fish Species

This alternative would not alter the current DEC liming program which includes only two waters in designated wilderness areas, Horn Lake and Tamarack Pond. Both of these waters are limed periodically to protect the unique strains of brook trout present in these waters. This alternative would however have a major impact on the Adirondack Brook Trout Restoration and Enhancement Program. Fifteen of the 18 waters currently scheduled for liming under this federally funded program are in wilderness or primitive areas and would therefore be excluded from treatment under this alternative.

As is discussed in previous alternatives the DEC has a responsibility to manage fisheries on all state lands, not just in waters on certain land classifications. Numerous wilderness waters have become acidified as a result of acidic deposition and entire ecosystems have been lost. Restoration of a certain number of these degraded ecosystems is an important management objective in wilderness areas. A draft memorandum from DEC Commissioner Jorling specifically deals with fisheries management in wilderness areas and has been included as part of this FEIS (Appendix B). This memorandum includes specific wilderness guidelines relating to ecosystem restoration and other wilderness fisheries management issues. The primary purpose of aquatic resource management in wilderness, primitive, and canoe areas is to perpetuate natural aquatic ecosystems; including perpetuation of indigenous fish species on a self-sustaining basis. This is an important objective and is compatible with the State Land Master Plan and guidelines for wilderness. If the DEC were not allowed to restore fish populations and other aquatic life to these degraded ecosystems, then these wilderness areas would continue to exhibit the adverse impacts of man's pollution of these ecosystems by acidic deposition.

Although liming is considered by some to be a manipulation and intrusion of the wilderness, the reason for the activity is to restore life to ecosystems which have become degraded by man's activities. In order to accomplish liming projects in wilderness areas helicopters have been utilized and are judged by the DEC to be the most unobtrusive method. Helicopter use in wilderness areas is objectionable to some because of the noise. However the helicopter noise would occur approximately once every six years over a one or two

day period. In contrast the beneficial impacts to the wilderness ecosystems of restoring a viable aquatic community to a water would be evident over a long period of time. The result of a wilderness liming project would most likely be an increase in the quality of the wilderness and a greater likelihood of wilderness users to encounter an osprey, loon, or otter on the pond or to see a fish rising for a fly on the pond surface.

Since liming in wilderness areas will be conducted within the guidelines of State Land Master Plans and unit management plans, it appears unwise to restrict the DEC program to only waters outside of these wilderness areas. Management of certain wilderness waters is necessary to help restore, preserve, and protect the natural conditions of the wilderness.

#### I. Genetically Select and Stock More Acid Resistant Strains of Fish

Genetically selecting and stocking more acid resistant strains of fish is a valid activity and is currently being done in New York State. However, as an alternative to the proposed liming program the results would be poor and unsatisfactory. Liming can restore an acidic environment with a pH of 4.5 to a satisfactory environment with a pH of 6.5, but "acid resistant" strains of fish may only be able to tolerate a pH of 5.1 compared with a pH of 5.5 for acid sensitive strains. In other words, even the acid resistant strains are susceptible to the acidity found in many acidified waters. If these acidic waters were stocked with acid resistant strains of brook trout, the fish could not survive.

Gloss et al. (1987) reported that in two acidic lakes (pH 4.8-5.0) neither acclimation procedures or experimental selection of brook trout for acid tolerance improved survival. The acidity of the water was too great for even the more acid resistant strains of fish. Schofield et al. (1986) similarly noted that as certain limed ponds reacidified the ponds with high flushing rates reacidified rapidly and exceeded the tolerance range of both acid-selected and un-selected groups of brook trout. In this case ponds with low flushing rates and a reliming program would be expected to produce better results.

There is value however in stocking acid resistant strains in marginal waters and continuing research to genetically select strains that are more resistant. The DEC has for a number of years been stocking Adirondack ponded waters with Temiscamie X domestic hybrid brook trout. One of the desirable characteristics of this hybrid is its greater resistance to acidic conditions, which would mean higher survival rates if episodes of acidic conditions were to occur. Cornell University researchers are continuing to evaluate the genetics involved in selectively breeding brook trout more resistant to acidity. The results of their work may lead to strains of fish which would survive in even more highly acidic conditions. Although genetically selecting and stocking these fish is not viewed as a viable alternative to the DEC liming program, it is still a fisheries management tool of value and importance.

#### J. Lime Watershed in Order to Lime Whole Ecosystem

Watershed liming is still viewed by the DEC and other organizations as a method of liming which needs additional research. As was discussed in other sections of this document the extension of the Lake Acidification Mitigation Project will consist of an intensive evaluation of the impacts of watershed liming on all components of the ecosystem, aquatic and terrestrial. A research project on Loch Fleet in Scotland is also evaluating the impacts and effectiveness of watershed liming, but this watershed contains vegetation quite different from most New York State watersheds. An evaluation of all the long and short term impacts of watershed liming is imperative before such a technique is recommended.

The liming of an entire watershed would undoubtedly require a larger quantity of lime, greater effort, and a more intensive monitoring program. The effect of such a liming on the lake or pond, however, may be longer lasting and may also help protect the aquatic system from acidic episodes. Many questions remain to be answered, and it is not advisable at this time to suggest watershed liming as an alternative to the DEC lake liming program.