

Human Response to Coastal Erosion: Thunder Bay, Lake Superior

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ABSTRACT

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Human awareness of erosion is high among residents along the north shore of Lake Superior around Thunder Bay, Ontario. Two-thirds of shoreline owners had suffered from the effects of erosion of their property over the last five years, and most perceive this erosion to be increasing. Political response is not seen to be very useful, and no respondents had made use of an Ontario provincial assistance program. Many would like the lake level lowered, by increasing outflow at Sault Ste Marie and limiting diversions into the lake, despite evidence that human intervention has little effect. So far the human reaction has been to tolerate the erosion or to rely on inexpensive physical shore protection measures. Although respondents recognize that combinations of defences are likely to be most effective, nearly half of those who have taken action have done so by simply adding fill as beach nourishment. A majority of shoreline residents would like the federal or provincial governments to pay some of the cost, but are generally willing to share the expense. Altogether the population appears to be tolerant of erosion as a natural process, willing to take simple mitigation measures, and mildly hopeful that someone else might help pay for it.

ADDITIONAL INDEX WORDS: *Coastal erosion, coastal management, coastal protection, natural hazards.*

INTRODUCTION

In studies of human response to natural hazards, most emphasis has been placed on high-magnitude episodic hazards, such as floods (RAMCHANDRAN and THAKUR, 1974), earthquakes (JACKSON and MUKERJEE, 1974), volcanoes (MURTON and SHIMABUKURO, 1974) and tornadoes (SIMS and BAUMANN, 1972). Erosion of the coastline has attracted less attention, as it is not seen as a threateningly serious problem. "Erosion poses no direct threat to human life and it is a low-frequency, continuous hazard which tends to affect areas used primarily for recreation" (FURUETH and IVES, 1987: 185). However, erosion of the shoreline can cause inconvenience, loss of amenity, and expense; both private and public expense, to repair damage and to try to prevent future damage. Regardless of shoreline changes, there is a strong demand for private property fronting water (FISCHER,

1986). People build homes and other structures in areas where there is a potential for problems; on the assumption, or with the hope, that there will be no problems while they occupy the structures (DITTON *et al.*, 1977).

Canada has large stretches of remote and undeveloped coastline, but the more densely settled coastal urban centres and their hinterlands are having to face resource management problems of the type appearing in similar urban areas around the world (HARRISON and PARKES, 1983). Pressing examples are developing along the shorelines of the Great Lakes. It was observed in 1987 that:

Few problems have attracted more attention among shoreline residents and governments in Ontario and Great Lakes States over the past two years than high lake levels and storms... Increasing use of the Great Lakes shore is reflected in increasing property damage over the past three decades (KREUTZWISER, 1987: 150-151).

Although in some parts of the world there is a move to equate coastal management with hazard avoidance, and to prefer "land use planning controls that are simple, prescriptive and restrictive" (KIRK, 1987: 239), in North America the engineered solution is still widespread. Until recently there have been few attempts by government agencies at any level to discourage human encroachment into shore areas subject to flooding and erosion (DAVIDSON-ARNOTT and KREUTZWISER, 1985). In part, no doubt, this arises from the attitude described by CLAWSON (1972: 80): "We live in an age when the 'natural' environment is largely what we make it; we can attain most of what we want, if we really try; and if we fail the fault is ours." The result is usually to try to stop shoreline erosion by physical means. Unfortunately, most people are simply unaware of the dynamic nature of the processes involved; of the effects of tides, winds, waves, longshore currents and rivers in eroding and building up shorelines (DITTON *et al.*, 1977). PILKEY (1987: 277) remarks that "We have only recently recognized the very long range and high cost of any kind of stabilization; that everything we do on the shoreline is temporary."

For shoreline property owners, of course, the principal purpose of erosion control is to protect private property and structures along the shore. The term 'coastal protection' is thus a misnomer to the extent that it is not the coast which is protected, but assets on it (KIRK, 1987). However, the Ontario Shoreline Management Advisory Council noted that:

Shore protection measures act to reduce the rate of erosion for a period of time, but do not eliminate erosion altogether. . . . Council has seen a number of shore protection measures that have negative impacts not only on downdrift properties but also on the property which they are meant to protect. . . . Shore protection along the Great Lakes that will remain effective for a long period (say 20 years) is relatively expensive to build and maintain when compared to the cost of an average cottage or residence. . . . in many cases, the costs of shore protection works are greater than the value of the property they were constructed to protect (ONTARIO, 1988: 15).

FLUCTUATIONS OF LAKE SUPERIOR WATER LEVEL

Lake Superior is the largest of the Great Lakes, with a total area of over 82,000 km². Waves on exposed shores, where fetches may exceed 500 km, can reach 6 m (RESIO and VINCENT, 1978). Thunder Bay is much more sheltered: maximum fetch is no more than 50 km and waves rarely exceed 2 m in height. The water level of Lake Superior fluctuates on both long-term and seasonal bases. Since monitoring began in 1860, the lowest mean annual level of Lake Superior was recorded in 1925-26 at 182.8 m. The other extreme occurred in 1985-86, when new monthly record highs were set for 12 consecutive months, at levels exceeding 183.4 m. Long-term fluctuations appear to have an irregular cycle: high water levels were experienced in 1915-16, 1950-52, 1972-74 and 1985-86. Seasonal regimes are more predictable: the lake normally fluctuates about 30 cm, being lowest just before the snow melts in spring and highest in September. More spectacular changes in level result from short-term (hourly) oscillations of the lake surface induced primarily by winds and differential barometric pressures. Wind set-up and *seiche* or barometric surface tilt may raise or lower the lake level along a given shore by as much as 1 m within a period of a few hours (OWENS, 1979).

The principal causes of long-term fluctuations in the level of Lake Superior (and the other Great Lakes) are natural, and can be explained in terms of the lake's water budget. When inputs of precipitation, ground water, surface runoff and streamflow exceed the outputs of evaporation and outflow from the lake for a significant period of time, the lake level rises. The most important variables are precipitation and evaporation. An extended period of below-normal precipitation in the 1960s was characterized by low lake levels. In contrast, precipitation was above normal for 13 of the 16 years between 1960 and 1985, resulting in high water levels in all five Great Lakes. On a long-term basis, Lake Superior basin precipitation and water levels have gradually increased since 1900 (BAKER and OTTERSON, 1987). In addition, the Great Lakes have been in a cool air temperature regime since 1960, resulting in lower evaporation and higher runoff rates than

would occur with average temperatures (QUINN, 1987).

Lake levels are also affected by human regulation systems. Outflow is regulated through the locks at Sault Ste Marie by the International Joint Commission (IJC), while two diversion structures (Ogoki River and Long Lac) divert about 500 m³/s of streamflow from the Hudson Bay basin into Lake Superior (Great Lakes Commission, 1986). Working under an agreement known as Plan 1977, the IJC strives to keep Lake Superior's monthly mean level between 182.8 and 183.4 m, while balancing water levels between Lake Superior and Lakes Michigan, Huron and Erie. However, the lake's natural water balance overrides the effects of human regulation systems. If the natural balance remains unchanged, then the greatest effect human control of outflow could have on the level of Lake Superior is less than 8 cm in six months (YEE, 1990). The main objective of this paper is to study human response to coastal erosion along the 50 km shoreline of Thunder Bay, with particular reference to the 1985-86 high water period.

METHOD

The city of Thunder Bay, which is named after the lake feature, is the largest city (population 122,000) on the Canadian shore of Lake Superior. There is a considerable amount of summer cottage development; not only for the local population but also for visitors from the Great Lakes states (notably Minnesota). There is a growing trend to conversion of these recreational dwellings into permanent homes (REINDERS, 1983). Most of this development has taken place east of the city; principally in the Township of Shuniah, which stretches from city limits to the base of the Sibley peninsula (Figure 1).

Shuniah has about 1300 shoreline dwellings; as well as about 600 inland properties, most not more than a few kilometres from the lake. To get some idea of the incidence of shoreline erosion and the human response to it, a questionnaire (Appendix A) was distributed to all residents, courtesy of the Township Council, with the June 1987 tax returns. In all, 133 (just over 10%) responses were received from lakeshore residents, and a further 51 (8.5%) from inland property owners. If absentee owners, renters,

and the owners of vacant property—few of whom returned the survey—were excluded, the percentage of responses might have been as much as twice as high. As it is, the response data are used descriptively, with no attempt at rigorous statistical analysis.

AWARENESS OF THE HAZARD

Studies in the United States have shown that those living along the shoreline are very familiar with flooding and erosion problems (MITCHELL, 1974; PILKEY, 1987; RASID and HUFFERD, 1989). In the east "coast dwellers exhibited an extremely high awareness of past experience, even when it was not their own" (BURTON *et al.*, 1969: 155), while in California understanding of the problem was very high in the hazard zone, diminishing a short distance inland (ROWNTREE, 1974). Awareness of shoreline erosion is likewise high in Shuniah. As in California, those exposed to the hazard were most familiar with it, with no fewer than 94% of those living along the shoreline recognizing that there was an erosion problem. However, the Shuniah data provide no support for Rowntree's assertion that coastal erosion has little meaning except for those persons whose homes are directly threatened. In Shuniah, even among those with no shoreline property, fewer than 20% were unaware of the problem.

Of those who live on the shoreline and are aware of the erosion problem, 67% reported that their property had suffered some erosion over the last few years (Table 1). The 27 beaches in Shuniah were grouped into five zones (Figure 1). Reported erosion is high all along the shore from Thunder Bay city limits to Perry Point in the east; though a little lower in the well-indented Mackenzie Bay, which also has two small offshore islands to help break up waves. Beyond Perry Point the beaches are sheltered by the Sibley Peninsula and by Keshkaboun (Caribou) Island and reported erosion in this zone is much lower than elsewhere: less than half of the overall average.

Some caution is needed in interpreting the figures for amount of land lost to erosion over the last five years. Respondents were asked to estimate losses, and it is doubtful if many took careful measurements. Figures such as 47 and 35 feet may well be the result of exaggeration for effect. Only 17 (23%) claimed to have lost

Table 1. *Shoreline erosion by beach zone.*

	Lakeshore Beaches	Mary Harbour	Mackenzie Bay	Amethyst Bay	East End	Total
Respondents Reporting Erosion	72% [N = 18]	95% [N = 21]	56% [N = 18]	78% [N = 41]	37% [N = 31]	67% [N = 133]
Median Feet of Erosion Reported	8 [N = 11]	5 [N = 16]	4 [N = 9]	8 [N = 25]	5 [N = 10]	5 [N = 73]
Respondents Perceiving Increase in Erosion	85% [N = 13]	80% [N = 20]	70% [N = 10]	78% [N = 32]	55% [N = 11]	76% [N = 89]

more than 10 feet of their property to erosion. The median amount was five, with a range from four to eight feet for the various beach zones. An average loss of one foot of land a year does not suggest that it is a major problem in the area. In nearby Lake County, Minnesota, for instance, over half of the respondents reported losses in excess of 10 feet and some of more than 50 feet (RASID *et al.*, 1989). However, Shuniah respondents generally seemed to think that erosion was increasing. Not one of those reporting suffering any erosion perceived the rate of loss as having lessened over the last five years, while more than three out of four saw it as increasing. This trend holds throughout the area, again with the exception of the East End.

Overall, therefore, beach residents in Shuniah are very aware of the erosion problem, and most have suffered from loss of beach-front property over the last few years. This erosion is generally seen to be increasing, though for most it does not involve major losses of land. This pattern is fairly general, though those on the sheltered eastern beaches have suffered less than average.

COPING WITH THE HAZARD

Political Action

To what extent has this high level of awareness led to action on the part of the sufferers? Just over a third of those who reported losing land to erosion said that they had made any attempt, personally or with others, to bring the problem of shoreline erosion to the attention of politicians or governmental agencies. The type of political action most often taken was to attend meetings (Table 2). Otherwise, the most common action was to speak or write to someone in government, with federal, provincial and

municipal levels being approached about equally.

Respondents were not convinced of the efficacy of any of these actions. There was a general impression that meetings and contacts with Shuniah Council helped to increase official awareness of the erosion problem. However, only two respondents felt that their efforts had resulted in any positive action; overall the federal level was seen as the least responsive. Moreover, despite the existence of a provincial government program (the Shoreline Property Assistance Act) extending reduced-interest loans to those suffering from shoreline erosion, not one respondent had taken advantage of this scheme, and not one knew of anyone else who had. This accords with the findings of DAY *et al.* (1977) on the Lake Erie shore, where approximately 75% of respondents were unaware of any government assistance of potential benefit to them.

Shore Protection

Nearly two-thirds of those who had suffered from shoreline erosion had taken steps themselves to try to decrease or prevent the erosion of their property (Table 3). Adding fill was the most favoured form of protection, though this rarely took the form of direct beach nourishment by the addition of sand, noted as growing in popularity in Florida and New Zealand (PILKEY, 1987; KIRK, 1987). In Shuniah most fill is in the form of rocks ('Rocks, BIG rocks; THOUSANDS of rocks', as one respondent wrote on his questionnaire). Adding fill is closely followed by the building of a retaining wall—again, often of rock. Few adopted other techniques, and few combined counter-measures. Forty respondents reported the amount of money they had spent on control or prevention of erosion. The median amount was only

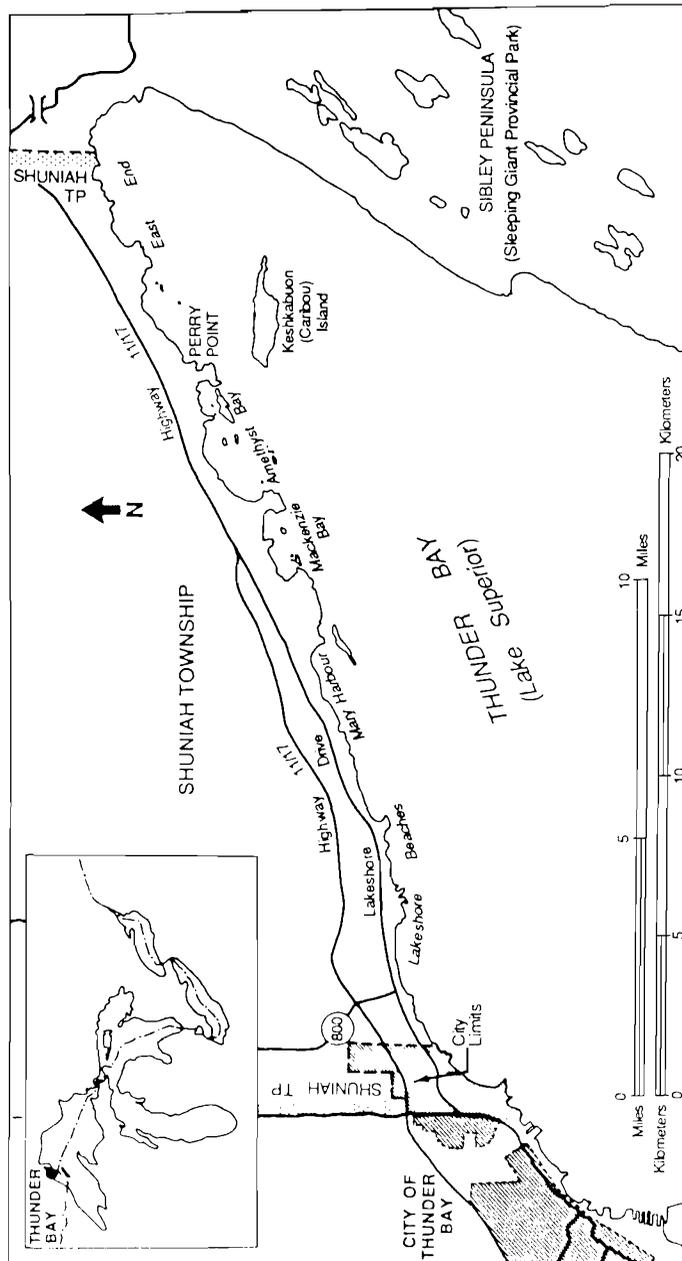


Figure 1. Study area at Thunder Bay, Shuniah Township, Ontario, Canada.

\$1000, suggesting that most were involved in only small-scale measures (several pointed out that they had also put in many hours of their own work). Only five claimed to have spent more than \$5,000.

Respondents were then asked to consider the usefulness of a number of steps that might be taken to counter shoreline erosion (Table 3). Building a retaining wall was most favoured, with the installation of piling, building of

Table 2. *Political action.*

	Attended meetings	Federal	Provincial	Municipal	Other
Action taken [N = 31]	20	8	9	9	9
Perceived Increase in Official Awareness	73%	37%	56%	72%	28%
No Perceived Effect	22%	56%	33%	22%	28%

[Some respondents noted two outcomes to the same action or actions. In these cases the values were divided equally]

Table 3. *Measures to counter erosion.*

	Actual measure adopted [N = 50]	Mention of measure	Proposed [N = 69]	Measure mentioned alone
Building a seawall	22	38		16
Installing piling	2	21		3
Building groins	6	19		10
Adding sand or fill	25	19		2
Planting vegetation	1	18		3
Moving cottage back	—	1		—
Other	—	6		5

groins, adding sand or fill and planting vegetation all about equally popular. Only one individual was prepared to consider moving the cottage. Many reported a willingness to consider combined measures, though few had actually done so. This suggests that respondents were well aware of the benefits of multiple measures, but were unwilling in practice to spend the time and money required. Of measures mentioned on their own, only a retaining wall or groins appeared more than three times. It is clear that respondents did not think it very useful to install piling or add fill without other measures. However, nearly half reported that they were, in fact, adding fill only.

Lowering the Lake Level

Asked whether lowering the level of Lake Superior would help, 93% of those who responded (N = 86) thought that it would. The Ontario Shoreline Management Council found this the most popular request made to them, despite the fact that all the evidence points to natural causes—notably precipitation and evaporation—as being responsible for most of

the fluctuations in lake levels (ONTARIO, 1988: 6). Of those in Shuniah who wanted the lake lowered, 63 specified by how much. One foot was the choice of over half and 95% favoured a reduction of not more than three feet. A small number wanted a reduction of up to seven feet; enough to leave shipping stranded. It is clear that the public is still not convinced that lake levels are largely beyond immediate human control.

Attitudes

With 58 of those affected by shoreline erosion taking some sort of practical steps to reduce the problem compared with 31 who have taken any sort of political action, it seems that the residents of Shuniah put rather more faith in their own structural defences. This emphasis on physical solutions runs counter to findings in North Carolina, where avoiding the problem altogether by means of land-use planning and building regulations was most popular, followed by the use of state and federal assistance to repair erosion-caused damage. In this case “the least popular form of adjustment was the

use of erosion control structures, including groins, jetties and seawalls" (FURUSETH and IVES, 1987: 188). There is no evidence in Shuniah of the disillusionment with physical structures found elsewhere in Ontario, where some property owners want to remove armour stone revetments constructed during recent periods of high water, to improve access to their beach or the appearance of their property (ONTARIO, 1988: 16).

PAYING FOR THE HAZARD

The argument is made by FURUSETH and IVES (1987) that as settlement expands on coastlines erosion is seen as a serious threat. This results in lobbying for government-funded erosion control assistance. A study on the Erie shore showed that those directly involved in an expensive government scheme overwhelmingly approved the idea of 100% government funding. Others, less directly involved, preferred a lower percentage of government support, giving most support to repayable grants (DAY *et al.*, 1977). In Shuniah, those who live on the shoreline felt particularly strongly that paying for damage or protection should be the responsibility of the federal and the provincial governments (Table 4). Nearly half agreed that the property owners themselves should bear some of the costs. There was little expectation that the municipality should pay. Shuniah residents living away from the shoreline put rather less emphasis on federal payouts and, not surprisingly, were more willing to see the property owners themselves financing the protective measures. The willingness of a significant number of even shoreline residents to finance their own repairs and defences may be partly due to a concern over too much government intervention. They may fear that accepting government assistance may lead to ministry demands for much stricter zoning regulations and to much greater pressure to relocate shoreline cottages (NELSON *et al.*,

1975). Property owners might like financial assistance, but not if it means giving up what they see as the right to do as they wish with their property (BROWER and BEATLEY, 1987).

CONCLUSION

Although Thunder Bay is a relatively low-magnitude hazard area, local residents—even those without shoreline property—are well aware of the existence of a shoreline erosion hazard. In the sheltered bay, wave action is much less intense and damaging than along more exposed shores elsewhere on Lake Superior or on ocean coasts. Residents of Shuniah, facing manageable costs for repairs and protection, have developed a degree of tolerance for coastal erosion. For those on the shoreline, the attractions of living in an environment of persistent appeal (TUAN, 1974) outweigh the costs involved. Coastal erosion generally—and especially in a low-magnitude hazard location such as Thunder Bay—is a much more predictable cost than that associated with most natural hazards. This can encourage the development of a "man in harmony with nature" attitude. In the circumstances the extreme attitudes of the passive "man as subject of nature" or the aggressive "man dominating nature" seem inappropriate. Individuals may take steps to protect themselves, but essentially recognize that the natural environment is unpredictable and that risk cannot be eliminated (KLUCK-HOHN, 1959).

There is little sign that property owners along the shores of Thunder Bay are being deterred by erosion. Only one respondent was prepared even to consider moving his cottage, and there is a fairly high level of willingness among residents to finance repair and defence work out of their own pockets. This suggests some suspicion that planning strings might be attached to any government involvement. What

Table 4. *Perceived responsibility for paying.*

	Federal	Government Provincial	Municipal	Property Owners
Shoreline owners [N = 121]	70%	63%	17%	48%
Others [N = 50]	54%	62%	18%	74%
Total [N = 171]	65%	63%	17%	56%

most people would like government to do is to lower lake levels, or at least to prevent them from regaining the high levels of 1985-86. Such action is effectively beyond the powers of any level of government, although this is not appreciated. Whether concern will grow as more and more expensive permanent homes replace the traditional summer cottages remains to be seen. To date, the human response to shoreline erosion hazard in Shuniah might best be summarized as a mixture of do-it-yourself and acceptance of the inevitable.

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APPENDIX A—QUESTIONNAIRE

[Note: Questions have been reformatted from the original.]

SHORELINE EROSION QUESTIONNAIRE

Please read even if you do not own any shoreline property.

The problem of erosion along the Superior shoreline is being studied by a small team of geographers from Lakehead University and the University of Minnesota, Duluth. It would be appreciated if you would take a few minutes to complete the following questions.

Please complete questions 1, 2 and 19 even if you do not own any shoreline property.

If you have any questions about this study, contact Robert Dilley or Harun Rasid at 345-2121.

Please return the completed questionnaire to the Shuniah Office as soon as possible. Thank you for your help.

(1) Do you have property fronting onto Lake

Superior? Yes/No (if No, answer the next question and then go to question 19)

(2) Have you heard that there is a problem with shoreline erosion in Shuniah?
Yes/No

(3) Please specify which beach your property is on:

(4) Is your property:
Occupied year round/Occupied seasonally/
Not occupied

(5) Has your property suffered any shoreline erosion over the last five years?
Yes/No (if No, go to question 19)

(6) How many feet of land would you estimate you have lost over the last five years?

(7) Over the last five years, has this erosion:
Increased/Remained about the same/Lessened

(8) Have you ever been involved, personally or with others, in any attempt to bring the problem of shoreline erosion to the attention of politicians or governmental agencies?
Yes/No (if No go to question 11)

(9) What steps have you taken to bring the problem of shoreline erosion to the attention of politicians or governmental agencies?

Attended meetings/Spoken or written to someone in Federal government/Spoken or written to someone in Provincial government/Spoken or written to someone on Shuniah council/Other

(10) Do you feel that these steps you have taken:

Have resulted in positive action/ Have increased official awareness of the problem/Have had no effect/Don't know

(11) Have you received any financial assistance from any branch of government over the last five years to help repair or prevent shoreline erosion?
Yes/No

(12) Do you know of anyone who has received such assistance?
Yes/No

(13) Have you taken any steps yourself to try to decrease or prevent the erosion of your property?
Yes/No (If No, go to question 16)

(14) What steps have you taken? (please specify)

- (15) How much do you estimate you have spent trying to decrease or prevent erosion of your property?
- (16) Do you think lowering the level of Superior would help prevent shoreline erosion?
Yes/No
- (17) How many feet do you think Superior should be lowered?
- (18) What steps do you think might usefully be taken to counter shoreline erosion:
Building a seawall/Installing piling or

other strengthening structures/Building groynes/Adding sand or fill/Planting grass or other vegetation/Moving cottage back from shore/Other (specify)

- (19) Who do you think should be responsible for paying for any measures taken to reduce or prevent shoreline damage? (If payment should be shared, check more than one):
Federal government/Provincial government/Shuniah township/Property owners.

□ RESUMEN □

La sensibilidad de los residentes en la costa Norte del Lago Superior en la Bahía de Thunder, Ontario, frente a la erosión es grande. 2/3 de los habitantes de la costa han sufrido los efectos de la erosión en sus propiedades en los últimos 5 años y la mayor parte de ellos es consciente de que la erosión va en aumento. Las medidas políticas no parecen haber sido muy útiles y no se ha hecho caso del programa provincial asistencial de Ontario. Como soluciones, se han planteado la reducción del nivel medio del lago aumentando el caudal de salida en Sault Ste.-Marie y la limitación del uso recreativo del lago; sin embargo, hasta ahora es evidente que la acción humana no ha tenido demasiado efecto. Hasta ahora, la reacción de la población ha sido tolerar la erosión o fiarse de medidas de protección de la costa de muy bajo presupuesto. Aunque se reconoce que las combinaciones de estructuras de protección pueden llegar a ser muy efectivas, hay que hacer constar que aproximadamente la mitad de las acciones emprendidas se basan únicamente en la regeneración de algunas playas. La mayor parte de los residentes en esta zona están a favor de que sea el gobierno federal o provincial el encargado de pagar los costes, aunque están dispuestos a repartir los mismos. Se puede concluir que la probación parece ser tolerante entendiendo la erosión como un proceso natural. Únicamente esperan que se tomen medidas para reducir ligeramente el problema con la leve esperanza de que alguien se haga responsable de sus costes.—*Department of Water Sciences, University of Cantabria, Santander, Spain.*

□ RÉSUMÉ □

Les résidents de la côte Nord du Lac Supérieur (Thunder Bay, Ontario) ont fortement conscience de l'érosion de leurs plages. Les 2/3 des possesseurs de terrains en ont souffert durant les cinq dernières années et la plupart perçoivent cette érosion comme un accroissement. La réponse politique n'est pas sentie comme très utile et aucun défendeur n'a utilisé un programme d'assistance provinciale. Malgré une nette conscience que l'intervention humaine n'a que peu d'effet, beaucoup voudraient que le niveau de lac soit abaissé en y limitant les diversions, et en augmentant l'effet de chasse à son débouché à Sault-Sainte Marie. La réaction humaine a toujours été de tolérer l'érosion ou de recourir à des moyens peu coûteux de protection physique des côtes. Bien que les défenseurs reconnaissent que la combinaison des défenses devrait être plus efficace, la plupart de ceux qui ont tenté une action ont simplement rempli la plage pour la reengraisser. La majeure partie des résidents aimerait que le gouvernement fédéral ou provincial paie une partie de ce prix, mais ils sont prêts à partager les dépenses. En même temps, la population semble tolérer l'érosion comme processus naturel et désire seulement prendre des mesures d'atténuation simples et espère un peu que d'autres pourront aussi les payer.—*Catherine Bressolier, Géomorphologie EPHE, Montrouge, France.*

□ ZUSAMMENFASSUNG □

Die Bewohner der Nordküste des Oberen Sees um die Thunder Bay in Ontario sind sich der Küstenerosion wohl bewußt. 2/3 der Anlieger haben in den letzten 5 Jahren durch die Erosion Landverluste erlitten, und die meisten haben erkannt, daß die Erosion zunimmt. Politische Verantwortlichkeit scheint nicht gesehen zu werden, und kein Betroffener hat bisher Gebrauch vom Hilfsprogramm der Provinz Ontario gemacht. Viele wünschen, daß der Seespiegel abgesenkt wird, indem die Zuflüsse eingeschränkt und der Abfluß bei St. Marie gesteigert wird, obwohl man annimmt, daß menschliche Einflußnahme nur wenig nützt. Bisher haben die Menschen die Erosion eher toleriert oder sich auf billige Schutzmaßnahmen verlassen. Obwohl die Verantwortlichen erkannt haben, daß eine Kombination verschiedener Schutzmaßnahmen am effektivsten ist, hat doch fast die Hälfte derjenigen, die aktiv geworden sind, lediglich Materialverfüllungen zum Strandschutz verwendet. Eine Mehrheit der Küstenanwohner verlangt, daß die Bundesregierung oder Provinzregierung einen Teil der Kosten übernimmt, sind aber generell gewillt, sich an den Kosten zu beteiligen. Insgesamt scheint die Bevölkerung die Erosion als einen natürlichen Prozeß zu tolerieren und ist bereit, einfache Ausbesserungsmaßnahmen zu ergreifen, wobei sie im stillen hofft, daß jemand sich an den Kosten beteiligt.—*Dieter Kellertat, Essen/FRG.*