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The Impact of Mad Cow Disease in Quebec: What to Do with Animal Carcasses?

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The Issue

In recent years, after the *bovine spongiform encephalopathy* (BSE, or mad cow disease) crisis in Europe, and after the first case of BSE was found in Alberta, both regulation and producers' initiatives have led to an ever smaller demand for meat meal and animal fat used in animal feed. Meat meal and animal fat were produced in great part from the rendering of carcasses, i.e., animals that died on the farm due to disease or accident. In Quebec, agricultural producers used to sell the carcasses to rendering plants. Now however, demand for meat meal and animal fat has all but disappeared, so producers must instead pay the rendering plants to dispose of the carcasses. The financial burden gives producers an incentive to get rid of the carcasses in less costly ways, not only by legal burial at the farm, but also by illegal disposal at the farm or elsewhere in nature (Deglise, 2003; Radio-Canada, 2003; Larivière, 2003a; Mercier, 2004). This leads to increasing environmental risks, specifically, soil, water and air pollution as well as potential health hazards, that need to be addressed.



Implications and Conclusions

Environmental policies relating to the disposal of carcasses are difficult to implement because the government has imperfect information about producers' practices. Subsidies would likely be necessary in order to improve that information and trigger legal behaviour. New markets for carcasses could also be encouraged, in particular the biodiesel market, which could lead to multiple environmental benefits.

1. Background

The Quebec Agriculture Ministry (MAPAQ) recognizes only three options for carcass disposal: rendering, legal burial and incineration (*La Terre de Chez-Nous*, 2003a). Legal burial is regulated with environmental constraints in Quebec. For example, areas that flooded up to 20 years ago are not suitable, there must be a distance of at least 75 m to a water stream and 150 m to a drinking water source, the excavation must be deep enough but above underground water, the carcass must be covered with caustic lime and it must all be covered with at least 60 cm of soil on a flat terrain (MAPAQ, 2003). Due to these constraints, in most cases we can expect legal burial of carcasses to be more costly than illegal burial.

In order to be legal, incineration must satisfy the norms of the Quebec Ministry of Environment (Langelier, 2000). One important sanitary issue is that mad cow disease prions (i.e., concentrated animal protein that can transmit BSE) are not always destroyed during incineration (*La Terre de Chez-Nous*, 2004; Redvers, 1996). This shortcoming implies the potential for contamination of animals and humans, with risks of infection with some forms of Creutzfeldt-Jakob disease (CJD) in humans. So there are sanitary risks with incineration; in addition, incineration at the farm is not affordable enough to become widespread (Larivière, 2003c), nor is it favoured by the Quebec Ministry of Agriculture (MAPAQ, 2003). However, pilot projects are underway to assess the feasibility, safety and costs of different incinerators available on the market (Conseil pour le développement de l'agriculture du Québec (CDAQ), 2005b).

Of the three recognized options, rendering was preferred by most producers, so new options must be found. In the meantime, the illegal disposal of carcasses leads to increasing environmental risks that need to be addressed. The issue is not negligible, since each year in Quebec about 6.5 million farm animals die before reaching the slaughtering age, especially milking cows, beef cattle, hogs, sheep and poultry (Deglise, 2003).

2. Conceptual Framework

In order to maximize social welfare, the economic distortions that characterize the carcass-rendering market in Quebec must be identified and corrected. There are currently three such distortions or departures from the ideal situation.

First, the rendering plant, Sanimal, is a monopoly. Indeed, under recent developments Sanimal has gone from being a monopsony, buying carcasses as inputs into its production, to being a monopoly as a service firm that requires payments from farmers to dispose of animal carcasses. This circumstance implies that the firm collects and disposes of too few carcasses at too high a price as compared to the perfect competition equilibrium. Second, the environmental risks related to the illegal disposal of carcasses are public, that is, they are shared by many people, while the costs of avoiding them are currently private, since agricultural producers are entirely responsible for them. Therefore, producers do not have proper incentives to pay as much as would be optimal for Sanimal's sanitary and environmental services (or for other legal options). Third, the government has imperfect information regarding the agricultural producers' legal and illegal actions. This is due to high monitoring and enforcement costs.

In the following section we discuss policies that could help to alleviate the distortions. We also talk about potential new markets, possibly requiring R&D efforts.

3. Analysis

Policy instruments need to be developed to correct the three market distortions described above. The policy instruments are discussed in sections 3.1–3.3. New markets could also be considered; these are discussed in section 3.4.

3.1. Monopolistic Environmental Service

First, the price that producers pay for monopolistic Sanimal to dispose of the carcasses could be directly regulated. The deadweight loss would be decreased, maybe even eliminated, because agricultural producers would pay less for Sanimal's services and more carcasses would be sent to the firm. Other ways to achieve this are to subsidize or to tax Sanimal's operations in ways that would trigger optimal pricing.

In 1987 several rendering firms merged in Eastern Canada; these mergers led to the creation of Sanimal. The federal Competition Bureau tried for more than five years to prevent such a merger, without success. Sanimal even challenged the constitutionality of the Competition Tribunal at the Supreme Court. Ultimately, a March 1992 decision in favour of the concentration of rendering activities in Ontario benefited Sanimal, and the Competition Bureau did not challenge the mergers further (Vallières, 1992). This series of events suggests that direct price regulation is an unlikely solution, since it would likely imply going back to court over the same issues as were debated for more than five years.

Subsidies would of course be welcomed by Sanimal, but their political feasibility is questionable since the monopoly is already gaining a greater profit than it would under perfect competition. Taxpayers would likely object to such government expense. Another possibility is to impose a tax scheme on Sanimal's operations that would lead to optimal carcass disposal. Taxpayers would not object since the tax would go to the government's budget, but Sanimal would likely challenge such policy.

Finding a workable solution to the monopolistic distortion is therefore not an easy task. Theoretically, any of the three policies suggested, i.e., price regulation, tax or subsidy, would work, but the situation is complicated politically and legally. In addition, it is not clear that there is a political will to correct the distortion at this time.

3.2. Environmental Risks

Illegal disposal of carcasses has been a problem for a few years now. For example, in 2003, 14 rotting bovine carcasses were found in the woods and in a field on a producer's land in the Estrie region (Larivière, 2003a). An agricultural producers' union representative (UPA president in La Patrie, Bernard Lapointe) said that there would be more cases. According to him, burial of carcasses is problematic because it could lead to water contamination (Larivière, 2003a). Furthermore, a hog carcass was found floating in a river, and 9 deer carcasses were found on the ground after the snow melted in the spring of 2003 in the Outaouais region (Larivière, 2003a). So there is evidence of some illegal disposal of animal carcasses by producers in Quebec in recent years. This is not to say that this is a widespread phenomenon, but there certainly are greater incentives for illegal behaviour than before because the legal disposal of carcasses has become costlier. If better alternatives are not found rapidly, we would expect the illegal disposal of carcasses to increase over time.

Environmental risks due to the illegal disposal of carcasses are borne by the public. Leaving carcasses on the ground in hidden or remote areas or burying them without regard to the potential short-term and long-term impacts can lead to soil, water and air pollution as well as health hazards for animals and humans. This pollution can affect many more people than just the agricultural producers. However, the costs associated with the legal disposal of carcasses (by selling them to Sanimal or burying them according to environmental regulations) are borne solely by the agricultural producer. Clearly, agricultural producers have the wrong incentives, since they take into account only their own environmental risks associated with their decisions, and not those borne by the rest of the public. By leaving carcasses on the ground, away from their own land, producers minimize their cost; at the same time, they reduce their own environmental risks by transferring them to the public. This is because the environmental risks related to carcass disposal are heterogeneous in space, as they depend on wind directions, direction and speed of water leaching through the soil and direction of water streams. For the same reason, the environmental risks decrease with distance. The illegal disposal of carcasses results in lower marginal costs of environmental risk avoidance for producers, but higher expected marginal environmental damage for the public. Optimally, the private marginal cost to avoid environmental risks should be equal to the expected public marginal environmental damage. Therefore, government intervention is needed to internalize the environmental risks in private agricultural production.

In environmental policy, economic policy instruments are generally preferred to other less flexible, “command and control” instruments (Hanley, Shogren and White, 1997). This is because economic instruments lead to least-cost strategies for dealing with environmental risks in the short run. Furthermore, in the longer run, economic policy instruments give greater incentives for R&D and adoption of less environmentally risky technologies. Economic instruments are either price or quantity instruments. Price instruments are taxes, subsidies and legal liability, while quantity instruments are transferable quotas or, equivalently, tradable permit markets. Typically, environmental taxes and subsidies imply perfect knowledge of producers’ actions. Since in the case of animal carcasses the government has imperfect knowledge of producers’ actions, either feasible policies are greatly constrained, or a way must be found to improve such knowledge. In cases of imperfect information, economists typically look for policies that give the correct incentive for producers to reveal the information themselves, or at least some of it.

In the case of animal carcasses from agricultural production, permit markets would not be a good solution because of the imperfect information the government has. It would be easy for animal producers to sell permits, thus making money, while continuing to dispose of carcasses in an unsound manner. Everybody would want to behave this way, so there would be only sellers and few or no buyers in this market. A thin permit market would not be efficient, and it would not be an effective way to reduce the unsound disposal of carcasses. Over and above the thin permit market and its failure to reduce unsafe disposal of carcasses, another problem arises: such a market implies allowing some unsound disposal of carcasses, providing a producer has the proper permits. However, under current regulation, unsound disposal of carcasses is not legal. Hence, the entire regulation on carcass disposal would have to be amended. Given the issues of thin market, lack of results and current regulation constraints, the quantity instrument is not an option in this case.

Price instruments are another option. Animal producers could be charged a tax for not disposing of a carcass in an environmentally sound fashion. However, such a tax would be difficult to implement, again because of the imperfect information the regulator has. Revealing such information would lead to higher costs for agricultural producers, either through the tax or through costlier disposal, so they would tend to not reveal their environmentally unsound behaviour in order to avoid the extra cost. A taxation scheme would therefore not be an interesting option unless the regulator could obtain better information on producers’ actions at low cost.

Alternatively, an efficient subsidy would give producers the incentive to dispose of animal carcasses legally and to reveal information in order to obtain the maximum subsidy available. This is the carrot as opposed to the stick approach, which is more useful in cases where the regulator has imperfect information on producers’ behaviour and where it would be very costly to improve such information (see for example, Polasky and

Doremus, 1998). However, subsidizing producers who are already substantially subsidized could be an unpopular policy, especially since governments are rationalizing their services. Governments are less inclined than in the past to give out subsidies, and taxpayers would likely protest a subsidy that, after all, would only encourage *legal* behaviour. While theoretically taxes and subsidies could both be efficient instruments, in a case where the regulator has imperfect information on producers' behaviour, subsidies are better suited than taxes but political feasibility may be an issue.

Another kind of price instrument that is sometimes used in environmental policy is legal liability (Segerson, 1995). In this context, taxes and subsidies are replaced by fines and rewards, depending on whether one is caught behaving illegally or not. Agricultural producers could be rewarded for legal behaviour, which is tantamount to the subsidy we just described. On the other hand, a fine could be charged in the case of illegal disposal of carcasses. However, in the absence of perfect information on producers' actions, the regulator does not necessarily know when illegal behaviour has occurred, and in cases where there is evidence of illegal behaviour, it may not even be clear who the guilty party is. This is a problem similar to the difficulty with regulation of non-point source pollution in agriculture: if illegal behaviour is detected, the regulator is not sure who did it. Hence, in case of evidence of illegal carcass disposal in a given region, some game-theoretic scheme could be created, with fines to every suspect, that would force legal behaviour of all. Such game-theoretic schemes have been suggested to address the problem of non-point source pollution in agriculture (Segerson, 1988; Segerson and Wu, 2003). For example, if a carcass were found in nature, a high fine could be charged to *every* suspect, since the actually guilty party could not be found with the information the regulator would have. Under such a scheme, no one would have an incentive to cheat providing the fine and the probability of discovery of the carcass by the regulator were high enough. However, such schemes are likely to seem unfair to those who did behave legally and thus to be politically infeasible. In any case, they have yet to be observed empirically.

Overall then, it is difficult to find an environmental policy that would be effective as well as both legally and politically acceptable. This is due in part to the reluctance of governments and taxpayers to create new subsidy programs and in great part to the imperfect information that the government has on agricultural producers' actions.

3.3. *Imperfect Information*

As mentioned above, the government has imperfect information about agricultural producers' disposal of carcasses. One way to obtain information is through better monitoring in order to enforce environmental regulations. However, these activities are costly, which is why they are imperfect in the first place (this rationale was first presented in economics by Becker in 1968). Indeed the cost of monitoring all agricultural producers at all times is too great to be worth implementing.

One avenue through which information could perhaps be obtained is the new traceability system. In Quebec, the agricultural producers' union (UPA) and the Agriculture Ministry (MAPAQ) joined forces in 1998 and developed plans for a mandatory electronic traceability system in order for the industry to react rapidly in the case of an epidemiological crisis. Consequently, the Quebec Animal Health Protection Act was introduced in 2000 (R.S.Q., c. P-42, s. 22.1; 2000, c. 40, s.14) and in 2001, Agri-Traçabilité Québec (ATQ) was created. ATQ is an autonomous, nonprofit organization whose mandate is to co-ordinate traceability efforts so that the information database on animals is centralized (Laronde, 2004; Agri-Traçabilité Québec, 2004.). Information is collected on animals, ownership, transfer, geographic location – all this from birth or import to death or export. Bovines were given priority, and plans were made as well for sheep and hogs to be traceable in 2005. Under this system animals need to be accounted for at all times; hence, the illegal disposal of carcasses could be detected from the traceability database. However, ATQ is jointly overseen by the MAPAQ, la Financière Agricole and the UPA, and it is not clear that the transfer of traceability information in order to enforce environmental regulation would be allowed by all parties. Furthermore, if producers had fines or taxes to pay if they were found illegally disposing of carcasses, they would have an incentive to cheat on the traceability database *as well*, thus threatening the traceability system. The social costs of such actions could be high, since they could ultimately imply the loss of some export markets, lower prices for animal products and increased animal and human health hazards related to mad cow disease. Using the traceability system to obtain better information on the illegal behaviour of producers could endanger the system itself, so at first glance it is not a very promising option.

In conclusion to sections 3.1 through 3.3, the monopolistic rendering firm Sanimal ought to be regulated. Further, subsidizing or rewarding agricultural producers for the legal disposal of carcasses would give them the incentive to act legally and to reveal complete information about animals that have died on the farm. Political feasibility is in question, but it could be argued that this option is the only one that would lead to legal and presumably environmentally safe behaviour. This policy will now be referred to as the Sanimal regulation–producer subsidy, or SRPS, option.

3.4. *New Markets and Technology*

Another possibility is to look for new markets for carcasses. Essentially, the environmental problem at issue arose from a loss of the market for carcass by-products; finding new markets could thus be part of the solution.

One interesting alternative is to use carcasses to produce biodiesel, a solution that will be referred to here as the biodiesel option. A few years ago, one of the largest rendering firms in the United States, Griffin Industries, started producing and selling biodiesel (*Biocycle*, 1999). We therefore know that this solution is technically feasible. R&D financing may be necessary to improve cost-effectiveness, and tax or subsidy schemes

may also be necessary for such a market to be developed. However, it could be socially less costly if the government were to encourage the biodiesel option rather than the SRPS option. In fact, even if it were more costly for taxpayers, the biodiesel option would likely have extra environmental benefits. Indeed, the fact that use of biodiesel would replace some use of petrochemical diesel could lead to a decrease in emissions of greenhouse gases (GHGs). Such environmental benefits should be accounted for in the cost-benefit analysis of government intervention. Including the abatement of GHG emissions in the cost-benefit analysis increases the net benefit of the biodiesel option; this increase could make the difference between encouraging such a market or not. Comparative feasibility studies are necessary to assess which option is socially better, and biodiesel ought to be considered.

Note, however, that in Quebec biodiesel is already produced by a monopolistic firm, Lauralco, so greater biodiesel production could lead to even greater economic distortions in the biodiesel market (Radio Canada, 2004). That firm produces biodiesel mainly from sub-food grade vegetable oil, used fry oil and animal fats. (Rothsay/Laurenco, 2002a, 2002b and 2005; Agricom, 2004). Some government intervention would likely be needed in order to eliminate or alleviate the monopolistic distortion.

Another possibility is the composting of carcasses, which is done in some regions of the United States and in some Canadian provinces (Farrel, 2002; Cornell Waste Management Institute, 2002; Bérubé, 2003; Rynk, 2003; *La Terre de Chez-Nous*, 2003b; Larivière, 2002). Such composting currently is not allowed in Quebec, in part because one must be sure that the compost temperature in winter rises high enough to kill all pathogens. Composting of poultry carcasses has been tested in the past, but it has not led to any change in regulation so far (Larivière, 2002). Currently, pilot projects are underway for composting carcasses from hogs, bovines, sheep and goats (CDAQ, 2005a; Larivière, 2003b and 2003d; Charlebois, 2004). It takes up to a year to compost bovine carcasses, so results should be available within a year or so. Regulation regarding on-farm composting of animals could change once further information is available, and efforts for market development for compost could be made.

More marginally, an Alberta cement manufacturer has proposed to the Agriculture Ministry the use of meat meal in its production process (Bérubé, 2003). Indeed, cement plants sometimes use meat meal as fuel, and they can then use the resulting ashes in structural cement (Ontario Ministry of the Attorney General, 2004). Such use can decrease emissions of GHGs in the cement production process (Bérubé, 2003). This is an alternative market for meat meal, so cement plants' demand for meat meal should be estimated in order to assess this alternative further.

In summary, these and other new markets for animal carcasses could be developed through R&D financing and facilitation of the emergence of new markets.

4. Conclusion

In conclusion, we suggest two possible options for solving the problem of increasing environmental risks due to the illegal disposal of animal carcasses in Quebec. First, in the absence of new markets, the SRPS option is recommended. Under this option, Sanimal should be regulated such that it would decrease its carcass disposal price to producers. Given past legal challenges brought before the Competition Bureau, subsidizing optimal behaviour seems to be the least objectionable policy. Also under this option, producers should be subsidized to give them the incentive to behave legally. This course of action is recommended because taxes or fines for illegal disposal of carcasses would lead to producers hiding information from the government.

Second, new markets should be explored for the longer run. A technologically feasible alternative is the biodiesel option. If the net benefit of this option, including the abatement of GHG emissions, is greater than that of the SRPS option, then it should be chosen. Otherwise, the SRPS option is better. Additional potential markets are compost from animal carcasses and use of meat meal in the production process of cement plants. Feasibility studies and assessments of these new potential markets should also take into account the possible reduction in GHG emissions.

In the long run, R&D could make these markets more interesting by decreasing production costs. Furthermore, the development of other new markets for carcasses could be encouraged. This would involve looking at what is done in other regions and countries, as well as making R&D efforts to find new, environmentally safe uses of animal carcasses as inputs. Government financing is likely to be required for such R&D, since the environmental problem related to the illegal disposal of carcasses is a public one, i.e., environmental risks are borne by all.

References

- Agricom. 2004. Biodiesel: une entreprise du Québec va de l'avant. *La Voie Agricole*. <http://radio-canada.ca/actualite/lepoint/>, July 10, 2004.
- Agri-traçabilité Québec. 2004. Web site, main page: <http://www.agri-tracabilite.qc.ca/ang/index.html>, December 8, 2004 update.
- Becker, G. S. 1968. Crime and punishment: An economic approach. *The Journal of Political Economy* 76(2): 169-217.
- Bérubé, I. 2003. À qui la belle carcasse? *La Terre de Chez-Nous*, 1er octobre 2003.
- Biocycle. 1999. Rendering companies recycle grease into biodiesel fuel. *Biocycle* 40(10): 6.
- Charlebois, Y. 2004. Le compostage des animaux morts. *La Terre de Chez-Nous*, 26 août 2004, p. 12.
- Conseil pour le développement de l'agriculture du Québec (CDAQ). 2005a. Compostage d'animaux morts à la ferme, projet No 2104

- <http://www.cdaq.qc.ca/cdaq1/ShowDoc.asp?Rubrique=169&Document=169&NoProjet=816>; viewed on January 10, 2005
- Conseil pour le développement de l'agriculture du Québec (CDAQ). 2005b. Incinération des animaux morts à la ferme, projet No 2120
<http://www.cdaq.qc.ca/cdaq1/ShowDoc.asp?Rubrique=169&Document=169&NoProjet=882>; viewed on January 10, 2005
- Cornell Waste Management Institute. 2002. Natural rendering: Composting livestock mortality and butcher waste, Fact Sheet 2002.
<http://compost.css.cornell.edu/naturalrenderingFS.pdf>
- Deglise, F. 2003. Les agriculteurs réclament l'aide de l'état pour se débarrasser des carcasses. *Le Devoir*, 10 septembre 2003, p. A2.
- Farrel, M. 2002. Composters enter the natural rendering industry. *Biocycle* 43(10): 24-28.
- Hanley, N., J. F. Shogren, and B. White. 1997. *Environmental Economics in Theory and Practice*. Oxford and New York: Oxford University Press.
- Langelier, G. 2000. Gestion des animaux morts. Montréal: Centre québécois d'inspection des aliments et de santé animale (CQIASA).
- Larivière, T. 2002. Les alternatives à l'équarrissage. *La Terre de Chez-Nous*, 3 octobre 2002.
- Larivière, T. 2003a. Les carcasses refont surface. *La Terre de Chez-Nous*, 12 juin 2003.
- Larivière, T. 2003b. Des tests sur le compostage. *La Terre de Chez-Nous*, 3 juillet 2003.
- Larivière, T. 2003c. Concurrence dans l'incinération. *La Terre de Chez-Nous*, 23 octobre 2003.
- Larivière, T. 2003d. Le compostage pourra aller de l'avant. *La Terre de Chez-Nous*, 23 octobre 2003.
- Laronde, P. 2004. On-farm food safety strategy for Ontario. Background Paper, Working Group 5: Traceability. Ontario Ministry of Agriculture and Food.
http://www.gov.on.ca/OMAFRA/english/off/facts/back_gr5.htm; created January 16, 2004, viewed January 10, 2005.
- MAPAQ. 2003. Élimination des animaux morts dans les fermes. *La Terre de Chez-Nous*, 19 juin 2003, p. 19.
- Mercier, J. 2004. Des carcasses émergent. *La Terre de Chez-Nous*, 1er avril 2004, p. 8.
- Ontario Ministry of the Attorney General. 2004. Report of the meat regulatory and inspection review, chapter 7 (Disposal of meat production waste).
http://www.attorneygeneral.jus.gov.on.ca/english/about/pubs/meatinspectionreport/chapter_7.pdf
- Polasky, S., and H. Doremus. 1998. When the truth hurts: Endangered species policy on private land with imperfect information. *Journal of Environmental Economics and Management* 35(1): 22-47.
- Radio-Canada. 2003. Carcasses d'animaux enfouies à la ferme. Audio report, 8 septembre 2003. <http://radio-Canada.ca/regions/Quebec/nouvelles/20030908001-carcassesenfouies.shtml>
- Radio-Canada. 2004. De l'or noir à l'essence verte. Le Téléjournal, Archives. <http://radio-canada.ca/actualite/lepoint/>, 30:50 - 44:13, 7 décembre 2004.

- Redvers, R. 1996. Don't have a cow – What Canadians should know about Mad Cow disease. *Toronto Vegetarian Association Newsletter*, May/June 1996.
<http://www.veg.ca/newsletr/mayjun96/madcow.html>; viewed January 10, 2005.
- Rothsay/Laurencio Montreal. 2002a. *Biobus Newsletter*, Issue 1, April 2002.
http://www3.sympatico.ca/rothsay/images/e_biobus.pdf
- Rothsay/Laurencio Montreal. 2002b. *Biobus Newsletter*, Issue 2, October 2002.
<http://www3.sympatico.ca/rothsay/images/e2biobus.pdf>.
- Rothsay/Laurencio Montreal. 2005. Rothsay recycles: Improving the environment.
<http://www.rothsay.ca/montreal.html>
- Rynk, R. 2003. Large animal mortality composting goes mainstream. *Biocycle* 44(6): 44-50.
- Segerson, K. 1988. Uncertainty and incentives for nonpoint pollution control. *Journal of Environmental Economics and Management* 15(1): 87-98.
- Segerson, K. 1995. Liability and penalty structures in policy design. In *The Handbook of Environmental Economics*, ed. D. Bromley. Oxford: Basil Blackwell.
- Segerson, K., and J. Wu. 2003. Nonpoint pollution control: Inducing first-best outcomes through the use of threats. University of Connecticut Department of Economics Working Papers: 2003-03, 34 pages.
- La Terre de Chez-Nous*. 2003a. Les producteurs cherchent des alternatives à la récupération des animaux morts. *La Terre de Chez-Nous*, 21 juillet 2003.
- La Terre de Chez-Nous*. 2003b. Petit manuel du composteur de carcasses. *La Terre de Chez-Nous*, 24 juillet 2003.
- La Terre de Chez-Nous*. 2004. Digérer plutôt que brûler les prions. *La Terre de Chez-Nous*, 23 janvier 2004.
- Vallières, M. 1992. Concurrence: son appel refusé en Cour suprême, Sanimal doute d'une récidive du Bureau fédéral. *Les Affaires*, 22 août 1992, p. 12.