Public hearings regarding the use of pesticides and herbicides, including glyphosate, in the province

Dr. Céline Surette, Ph.D.
Dr. Luc Tremblay, Ph.D.

Departement of Chemistry and Biochemistry, Université de Moncton

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Introduction

- **Our presence is motivated by our concern about the significant use of glyphosate in the territory of NB, particularly in our forests.**
- **We believe it is important that NB scientists participate in the debate by presenting data (or lack of data) and their expert opinion.**
- **Thank you for this opportunity.**

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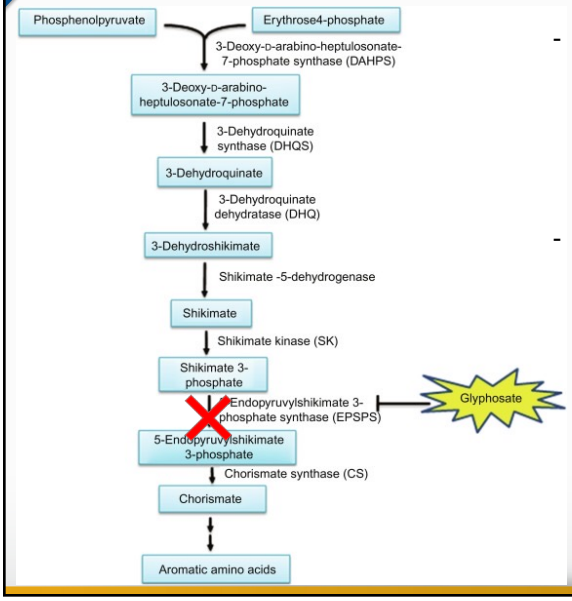
Acute toxicity of glyphosate



- Glyphosate inactivates an enzyme (EPSPS) involved in the production of amino acids using this metabolic pathway. Amino acids are the building blocs of proteins and cells.

- It kills (depending doses) these organisms using this pathway:
  - **Plants**
  (mostly grasses, deciduous tress)
  - **Microorganisms**
  (bacteria, fungi, algae, …)

(Van Bruggen et al., 2018)

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Effects of glyphosate on forests

Reduction of biodiversity:
- By eliminating plants at the base of foodweb (and shelters), we also modifiy animals.
- Possible long-term changes of the types of plant and animal species (Guynn et al., 2004).
- Persistance (> 1 yr) and effects longer in cold climates (Helander et al., 2012; Mertens et al., 2018).

Possible depletion of soil nutrients:
- Reduction of N-fixation
- Binding of minerals

More research needed (Mertens et al., 2018).

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Risks associated with forest fires

Lori Daniels (PhD forest ecology, University of British Columbia) has shown (CBC, 2019):

- Deciduous trees like aspen and birch are more resistant to fire.
- Keeping only coniferous trees causes fires to travel farther and faster.

Daniel Perrakis, Research Scientist at Canadian Forest Service: « by eliminating deciduous trees, we favor crown fires which are the most powerful and difficult to fight. » (Radio-Canada, 2019).

This question must be more studied and considered, considering that climate change should produce more forest fires.

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From soil to natural waters

ForestInfo.ca: « Due to the chemical structure of glyphosate, the product binds quickly to soil particles and is very unlikely to leach into the soil and ground water.»

However:

- We find glyphosate and its first decomposition product (AMPA) in the waters surrounding treated areas (even in Europe where genetically modified crops are not allowed).

Table 1
Glyphosate occurrence and concentrations in surface or ground water samples in several countries in North America, South America, and Europe.

Country	Date	Glyphosate occurrence and concentrations	Authors
Canada	2002	22% of samples positive, up to 6.07 μg l^{-1}	Humphries et al., 2005
US (Midwest)	2002	36% of stream samples positive, up to 8.7 μg l^{-1}	Battaglin et al., 2005
US (Midwest)	2013	44% of stream samples positive, up to 27.8 μg l^{-1}	Mahler et al., 2017
US (Washington, Maryland, Iowa, Wyoming)	2005–2006	All streams positive, up to 328 μg l^{-1}	Battaglin et al., 2009
US (Iowa, Indiana, Mississippi)	2004–2008	Most rivers positive, up to 430 μg l^{-1} after a storm	Coupe et al., 2011
Mexico	2015	All groundwater samples positive, up to 1.42 μg l^{-1}	Rendón-von Osten and Dzul-Caamal, 2017
Argentina	2012	35% of surface water samples positive, 0.1–7.6 μg l^{-1}	Aparicio et al., 2013
Germany	1998	Few positive samples in two tributaries to the Ruhr river, up to 0.59 μg l^{-1}	Skark et al., 1998
Switzerland	2016	Most stream water samples, up to 2.1 μg l^{-1}	Poiger et al., 2017
Spain	2007–2010	41% positive groundwater samples, up to 2.5 μg l^{-1}	Sanchis et al., 2012
Hungary	2010–2011	Most river and ground water samples positive, up to 0.001 μg l^{-1}	Mörtl et al., 2013
Denmark	1999–2009	25% of surface water samples positive, up to 31 μg l^{-1}; 4% of groundwater samples positive, up to 0.67 μg l^{-1}	Rosenbom et al., 2010
France	2003–2004	91% of stream samples positive, up to 165 μg l^{-1}	Villeneuve et al., 2011

References in Van Bruggen et al. (2018)

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From soil to natural waters

In Canada:
In this repport: « PRESENCE AND LEVELS OF PRIORITY PESTICIDES IN SELECTED CANADIAN AQUATIC ECOSYSTEMS »
Water Science and Technology Directorate -Environment Canada 2011:

«Glyphosate is the active ingredient with the highest sales volume in four of the five regions surveyed in this national water quality surveillance program, and yet was only measured in two of the provinces (**British Columbia and Ontario**). Future surveillance activities should include glyphosate in all environmental media due to the high sales volume.»

In British Columbia (Fraser Valley):
«The highest concentrations in runoff were measured for the herbicide **glyphosate**, glyphosate's transformation product AMPA and the fungicide metalaxyl. »

Range of concentrations: 2000 – 9000 ng/L

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Natural water contamination

ForestInfo.ca: « Given typical forest-use scenarios, the risk for **groundwater** contamination by glyphosate-based herbicides is substantially lower than that in agriculture, given :
- the small **percentage (!?)** of the forest land base that is ever treated,
- that applications are typically made only once per site in 40-80 year period,
- that treatment sites are **typically (!?)** very remote from drinking water sources »

However:

Even if glyphosate is more retained by clay-rich and organic-rich soils (where it can resist to degradation and persist for > 1 year, Chekan et al., 2016):

- it leaches much more easily in sandy soils
  (Bergström et al., 2011; Okada et al., 2016, Sidoli et al., 2016);
- it is partly dissolved during high rains and is transported
  (Maqueda et al., 2017; Rendón-von Osten et Dzul-Caamal, 2017);
- erosion can transport particles enriched in glyphosate towards natural waters
- areal spraying allows its transport by wind toward surface waters
- glyphosate is toxic for many aquatic species (ex. algae, amphibians) (Annett et al., 2014).

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And human health ?

- **No (few) studies on the risk of glyphosate use in forests**
  - One study in Colombia (Camacho 2017)
    - Increase in medical consultations linked to
      - Dermatological problems
      - Respiratory diseases
      - Increase in miscarriage
  - Small rural population exposed – very difficult to have strong epidemiological studies

Yet, we are all esposed to glyphosate

- Presence in urine of all studied populations (Gillezeau et al., 2019)
- Study in California comparing 1993 to 2016 : 5X increase in urine glyphosate (Solomon 2019)
- There is historical evidence of exposure in agricultural environments (Perry et al., 2019)
- Occupational exposure leads to higher concentration of glyphosate than environmental exposure

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Effects on human health

- **Cancer:**
  - 2015: International Agency for Research on Cancer classifies glyphosate as a probable carcinogen. This is controversial and since then several regulatory agencies have revised their position to say that it is probably not carcinogenic. → scientific debate remains unresolved, no consensus (Landrigan et Belpoggi, 2018)
  - Meta-analysis of epidemiological studies and animal model studies suggests an increased risk of Non-Hodgkin lymphoma (Zhang et al., 2019)
  - California: Court case won (in 2019) against Monsanto for a glyphosate user with cancer (Non-Hodgkin lymphoma) (Hardeman vs Monsanto)
- **Crohn disease?** Glyphosate capable of modifying intestinal microbiome in rats– assessment needed in humans, especially children. (Mao et al., 2018)
- Other health issues to study :
  - Respiratory diseases, dermatological problems, Maladies respiratoires, problèmes dermatologiques, reproductive system issues, Parkinson disease (Agostini et al., 2020)

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Few Canadian studies

- There is a 2007-2019 Canadian Health Measures Survey biomonitoring program: 279 different contaminants are measured- but not glyphosate (Haines et al., 2017)
- A study by the Canadian Food Inspection Agency (2017) finds that 30% of food contained traces of glyphosate, but little exceeded established health standards. up to 50% in the grains

In fact, although glyphosate is the most widely used pesticide in the world, there are very few large-scale studies on exposure or health effects.

« Thus, comprehensive epidemiological studies are needed to confirm GLY's safety to humans and to provide recommendations and guidelines to regulate its use. »
Agostini et al. (2020)

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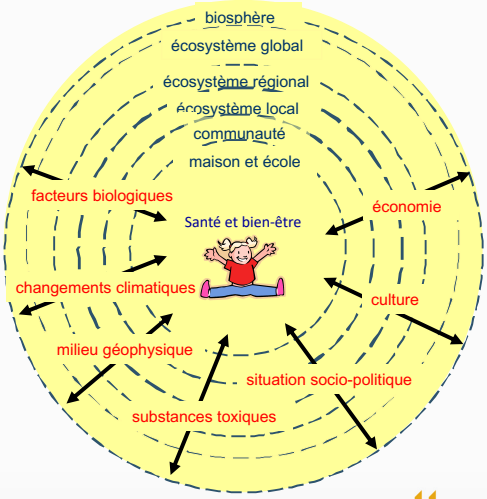
Determinants of health

- Determinants of health: we must look at the exposure to contaminants as a whole and by considering the complex interactions between health-environment-community
- Importance of understanding synergistic, combined effects
- Importance of using the precautionary principle, because absolute evidence is difficult to obtain



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Recommendations

Considering that:

- glyphosate, like all pesticides, should be use minimally, in an had hoc manner (in time and space) and when other solutions are not possible.
- NB is the province with the largest proportion of its territory that is treated with glyphosate in forestry.
- Glyphosate can be replaced by other economically viable solutions. Québec banned aerial spraying of herbicides in forests in 2001. The Maine legislature has just (June 2021) approved such a ban.

We recommend that aerial spraying cease in NB.

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Recommendations

- **Impact assessment** – Environmental impact assessments are done by project. Although EIAs take into account certain socio-economic considerations, on their own, they do not provide the full picture of the issues. We recommend the addition of a strategic and cumulative EIA to have a regional portrait of the impacts of this sector. We also recommend the addition of Health Impact Assessment independently conducted by the Office of the Chief Medical Officer of Health.
- **Monitoring** – We recommend that glyphosate and other pesticides be added to the list of parameters monitored by the Department of Environment and Local Governments in his next reports on The State of Water Quality in New Brunswick's Lakes and Rivers.
- **Independant research** – We recommend soliciting and funding more independent research to better understand the impacts of pesticides on health, environment and communities and to assess the suitability of current standards.

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