TD 83

First Name: Donald
Last Name: Gudehus
Email: gudehus@gmail.com
Address1: 3835 Meadow View Drive
City: Eugene
State: OR
Zip: 97408
Company:
Title:
Phone: 541-485-3797
Contact by: E-Mail
Issue Description: Dear Oregon Dept. of Forestry,

You have asked for public input on the direction of focus for your research budget. I think that emphasis can be placed on the effect of timber industry use of pesticides on human health and fish and wildlife well being. The pesticides drift onto private lands inhabited by people or onto public trails where hikers try to enjoy the outdoors. The pesticides not only kill species harmful to the timber industry's trees, but species that do no harm. Innocent species are harmed not only on the forest industry's lands, but on many public and private lands. Decreases in the abundance of butterflies, other insects, and certain wildlife is due not only to habitat destruction, but deliberate usage of pesticides. You can make a useful contribution to the betterment of human life and health and the protection of our natural resources by trying to reduce the harmful consequences of pesticide use.

Donald Gudehus

ID 54

First Name: Jocelyn
Last Name: Luciano
Email: info@summitawards.com
Address1: 2533 NW Pinnacle Dr
City: Portland
State: OR
Zip: 97229
Company:
Title:
Phone: 503-297-1822
Contact by: E-Mail

Issue Description:

Priority needs to be made to protect the public from the impact of chemicals that are applied to our forests.

Cancer statistic are on the rise and all of the new pollutants in our atmosphere only contribute.

Best regards,

Jocelyn

First Name: nancy
Last Name: hopps
Email: nancyhopps@hotmail.com
Address1: po box 5224
City: eugene
State: or
Zip: 97405
Company:
Title:
Phone: 541-683-9088
Contact by: Telephone
Issue Description: (Someone with more experience and writing skill has summed up my feelings thusly:)

ODF has not been tracking the scientific research on pesticides.

· ODF's research on long-term fates of herbicide applications was never completed. ODF needs to know if current policy is keeping significant amounts of chemicals out of streams.

· ODF has never researched chemical drift from aerial applications on forested land to neighboring properties. There are numerous well-documented studies that demonstrate the movement of pesticide vapors over long distances and there is also reliable medical research on the impacts to the public. ODF needs to refer to existing research or conduct research on the fate of aerially mobile herbicides.

· ODF involves "interest groups" and "stakeholders" in the review of policies but neighboring landowners and the public in general can be impacted by forestry chemical applications; however they are not adequately represented as an "interest group" or a "stakeholder". These people have very good reason to be a voice in the ODF process.

o Any person can suffer both long and short-term health effects from pesticides.

o Impacted landowners can include RR 2,5, and10 are adjacent to F1 and F2 land

o A significant percentage of the population have respiratory illnesses which put them at higher risk

o A growing number of the public are becoming chemically sensitive and are at extremely high risk

o Children from both adjacent properties and at schools are at higher risk for acute and chronic illness from pesticide exposures. There are many medical research reports regarding the impacts of pesticides to children.

o Organic farmers/gardeners are particularly at risk

o Home gardens on properties neighboring chemically treated forestland are at risk.

o ODF needs to show scientifically valid data supporting the current practice of allowing timber companies to spray herbicides repeatedly, sometimes many years in succession, on the same logged tracts.

o ODF has, on one occasion, contacted a single nonprofit organization to represent "environmental" interests. There are many organizations that represent environmental issues and rural community issues and ODF should increase the representation of this portion of the public. Some of these groups may fall into the category of public health advocacy, in addition to the traditional environmental advocacy interests.

****
****

THANK YOU for keeping the big picture and long term health effects in mind when making your decisions. Myself and my child have had cancer linked to environmental toxins. I would not wish that on you and yours.

ID 56

From: Lisa Arkin [mailto:larkin@oregontoxics.org]
Sent: Monday, July 23, 2007 2:48 PM
To: ota@lists.onenw.org
Subject: [ota] To: OTA Members Concerned About Forestry Herbicides. ACT NOW.

TO: OTA Members Concerned About Forestry Herbicides

UNIQUE OPPORTUNITY!

OTA is contacting you about an important opportunity for our voices to be heard at the Oregon Dept of Forestry. ODF is asking for comments from the public about what they should focus their research and budget during the next few years. For those of us with strong concerns about the use of chemicals by the timber industry- whether our issue is the impacts on human health or on fish and wildlife- we must urge them to make pesticide use in forestry and off-site chemical drift their top priorities.

ODF will accept comments from the public until July 31st.

YOU CAN PLAY AN IMPORTANT ROLE!

We have the potential to convince ODF that a significant segment of the public would like to see ODF give pesticide monitoring highest priority instead of the current medium to low priority. **The main part of any letter should stress the need for ODF to give high priority to Chemical Monitoring. Good policy must be based on good science!**

WHAT ARE THE ISSUES YOU CAN SPEAK TO?

Here are some important points for writing letters;

- ODF has not been tracking the scientific research on pesticides.
- ODF's research on long-term fates of herbicide applications was never completed. ODF needs to know if current policy is keeping significant amounts of chemicals out of streams.
- ODF has never researched chemical drift from aerial applications on forested land to neighboring properties. There are numerous well-documented studies that demonstrate the movement of pesticide vapors over long distances and there is also reliable medical research on the impacts to the public. ODF needs to refer to existing research or conduct research on the fate of aerially mobile herbicides.
- ODF involves "interest groups" and "stakeholders" in the review of policies but neighboring landowners and the public in general can be impacted by forestry chemical applications; however they are not adequately represented as an "interest group" or a "stakeholder". These people have very good reason to be a voice in the ODF process.

- Any person can suffer both long and short-term health effects from pesticides.
- Impacted landowners can include RR 2,5, and10 are adjacent to F1 and F2 land
- A significant percentage of the population have respiratory illnesses which put them at higher risk
- A growing number of the public are becoming chemically sensitive and are at extremely high risk
- Children from both adjacent properties and at schools are at higher risk for acute and chronic illness from pesticide exposures. There are many medical research reports regarding the impacts of pesticides to children.
- Organic farmers/gardeners are particularly at risk
- Home gardens on properties neighboring chemically treated forestland are at risk.
- ODF needs to show scientifically valid data supporting the current practice of allowing timber companies to spray herbicides repeatedly, sometimes many years in succession, on the same logged tracts.
- ODF has, on one occasion, contacted a single nonprofit organization to represent "environmental" interests. There are many organizations that represent environmental issues and rural community issues and ODF should increase the representation of this portion of the public. Some of these groups may fall into the category of public health advocacy, in addition to the traditional environmental advocacy interests.

- ODF lacks behind California and Washington in Forest Chemical impact awareness and in developing precautionary models. ODF should make Chemical Monitoring a high priority and merge their efforts to carry out research with other State and Federal agencies.
- Regarding Buffer Zones: A law suit against EPA in 2003 required 60' buffers for ground applications and 300' for aerial applications of specific pesticides in certain stream systems with threatened runs of salmon and steelhead. ODF should justify why the same would not be needed for people and domesticated animals

using the best available science. Buffer zones are the best means of separating chemical spray from unintended targets.

HOW TO SEND YOUR COMMENTS:

For information see http://egov.oregon.gov/ODF look at center photo "2007 Board of Forestry Issue Scan". "more" will take you to the next page with "Form for electronic suggestion submittal" and additional information. If you do not use the electronic form, your written comments of 500 words or less regarding the issue you are concerned about can be sent to ODF, Dan Postrel, Agency Affairs, 2600 State Street, Building B, Salem, OR. 97310. Be sure to include your name and address. You can also reach Dan Postrel at 503-945-7420.

ODF will accept comments from the public until July 31st.

We thank you for your advocacy, your caring and the emails you will send to ODF!!!

Lisa Arkin

Executive Director

Oregon Toxics Alliance

541-465-8860

larkin@oregontoxics.org

ID 57

First Name: Howard
Last Name: Sampley
Email: rsampley@peacehealth.org
Address1: 2778 St. Lucia st.
City: Eugene
State: OR
Zip: 97408
Company: individual
Title: M.D.
Phone: (541)349-0893
Contact by: E-Mail
Issue Description:

Issue:Monitoring and Restriction of herbicidal chemicals on ODF Lands.

concern- require use of best available science in the use of these chemicals,

sufficient buffer zones to application, especially aerial spray. This especially important on commercial tree stands where use of these chemicals is highest.

Request careful and adequate monitoring of the use of these chemicals- self reporting is not a sufficient standard. No spraying around stream and water should occur, the risk to fish and wildlife is too great. No chemicals should be allowed in use until they have been cleared for safety to humans, wildlife, fish etc. I do not believe that any of the Herbicides have ever been shown safe to such. The use of these chemicals is ultimatly questionable. Their propsed benefits are very limited and appear overrated.Their suspected health risks are severe. Please remember the Agent Orange lesson from the 60's. These chemicals continue to remain after the initial application, on leaf and in soil. They continue to rain down with each subsequent rainfall and continue to expose the understory (and all living creaetures present there,including humans) to a toxic mix. The health risks were not evident until decades later. These are highly toxic biologic agents. Please consider detailed monitoring and restriction of thier use as necessary due to public health risks. thank you for your attention to this matter.

First Name: Jim
Last Name: Carr
Email: jcarr@campbellgroup.com
Address1: PO Box 588
City: North Bend
State: OR
Zip: 97459
Company: Menasha/The Campbell Group
Title: Silviculture Forester
Phone: 541-756-1193
Contact by: Telephone
Issue Description:

In an effort to reduce the paperwork and workload for both landowners and stewardship foresters, I would like to suggest the elimination of the requirement for notification of operations for ground application of chemicals. The application is regulated by label, ODA, PURS reporting and the rules for application are substantial in the OFPA. Washington has very restrictive forest practice laws and the notification requirement for ground application of chemicals does not exist in their rules.

I appreciate your consideration of this suggestion.

First Name: David
Last Name: Webb
Email: dleonwebb@peoplepc.com
Address1: 88197 Nelson Mtn. Road
City: Walton
State: OR
Zip: 97490
Company:
Title:
Phone: 541-935-1189
Contact by: E-Mail

Issue Description:

My major concern is monitoring herbicide use on private lands. Our rules must be backed by hard science. ODF made a good start in 2000 when you found the herbicides didn't just do their job and go away as we all hope but remained in the adjacent creeks and rivers in many samples in the 24 hours after they were sprayed. Has there been followup research?

We used to "clean out" all the woody debris in our streams, and then later found out how flawed the practice was for aquatic health. We need to KNOW whether or not controlling vegetation with herbicides may similarly be a flawed practice. Platitudes are not research and the EPA regulators I have spoken to, admit that they really don't know what happens in the ecosystem, and continually find "unexpected surprises" in impacts on animal life.

I hope you will address this important issue in the future.

Thank you,

D. L. Webb

ID 60

July 2007

Dan Postrel
Oregon Department of Forestry
2600 State Street, Building B
Salem, OR 97310

Re: Issue Scan 2007

Thank you for taking comments from the public on Oregon Department of Forestry (ODF) work plans for the next two years. Please consider the following:

ID 60

1. Herbicides and other pesticides drift off the target sites and can travel long distances on air currents, affecting people, pets and wildlife, including salmon. ODF should use the best available science to guide policies for aerial application of herbicides, as follows:

- There are numerous well-documented studies that demonstrate the movement of pesticide droplets and vapors over long distances and there is also reliable medical research on the adverse impacts to the public. ODF needs to refer to existing research on the fate of aerially mobile herbicides, then act to protect public health, especially children.

- Monitoring of pesticide residues in the environment is strongly recommended. Even minute amounts of herbicide can adversely affect salmon and other anadromous species by altering their behavior and defenses in ways that diminish their survival. ODF policies should protect public resources such as air, water and forest ecosystems.

ID 61

2. Smoke from slash burning is a known health hazard from the particulates resulting from combustion. Additionally, combustion of the herbicide residues and plastic found on slash are known to add toxic chemicals to the air. ODF should do more to protect smaller communities and rural areas from smoke.

ID 62

3. ODF should strive for truly sustainable forestry and a precautionary approach, and do everything in its power to insure that more trees are planted, fewer are harvested, and all slash is chipped and returned to the soil instead of being burned. In the long term, ODF should work toward eliminating clear cutting, slash burning and all use of pesticides unless and until these practices can be proven safe for people, pets and wildlife, and sustainable for ecosystems.

Again, thank you for accepting public comments on ODF work plans.

Sincerely,

Robert Purdy
Janett Purdy

POB 264
Neal Rock, OR 97376

ID 63

First Name: Honey
Last Name: Vizer
Email: hvizer@hotmail.com
Address1: PO Box 133
City: Eugene
State: OR
Zip: 97440
Company:
Title:
Phone: 541 342 4040
Contact by: E-Mail
Issue Description:

Pesticide monitoring should be the highest priority.

ID 64

First Name: Rick
Last Name: Williams
Email: rwilliams@bc.com
Address1: 1300 Kaster Road
City: St. Helens
State: OR
Zip: 97051
Company: Boise Cascade LLC
Title: Fiber Procurement Manager
Phone: 503-397-9357
Contact by: E-Mail

Issue Description:

ID 64

Chemical monitoring - keep as low/medium priority. Do not duplicate research efforts of OSU and other universities.

ID 65

Intensive forest management - make this a high priority, particularly in the Tillamook Forest on the maximum acres possible. Manage the best site classes the most intensively. Low site classes and riparian/wetlands low priority. Spend your management and research dollars on lands that have the highest return on investment.

ID 66

First Name: michael
Last Name: Newton
Email: mike.newton@oregonstate.edu
Address1: Oregon State University College of forestry,
City: Corvallis
State: OR
Zip: 97331
Company: OSU
Title: Professor Emeritus
Phone: 541-737-6076
Contact by: E-Mail

Issue Description:

When dealing with issues of pesticides and their uses in forests, please ensure that the question of suitability for forest use is entirely dependent on an objective analysis of comparative safety and utility of all options for managing pests and vegetation in pursuit of management objectives.

I have been involved in research on forest chemicals for 48 years, including evaluations of potential hazard, water contamination and comparative efficacy for meeting long-term objectives. Please understand that, public opinion to the contrary, I have not found that non-chemical alternatives for controlling vegetation and other pests compare favorably either in safety or efficacy. My research has spanned environments including eastern Oregon, westside forests, and forests north to the Arctic Circle. All vegetation management chemicals presently legal for use have been evaluated exhaustively for persistence, dislodgeability, harm if actually taken in by fauna and movement in water as well as efficacy in selectively controlling undesirable plants. I have published more than 300 scientific reports and refereed publications on ecology and technology of their use, and this program continues. By far the dominant support for this work has been from public funds, both state and federal.

I am available for testimony on request. My work is known to Chairman Hobbs.

Michael Newton, Professor

ID 67

July 9, 2007

Richard Gross
92349 Deadwood Cr Rd
Deadwood, Or 97430

ODF
Attn: Dan Postrel, Agency Affairs
2600 State Street, Bldg B
Salem, Or 97310

Mr. Postrel:
I have long held concern for the wide-spread dispersal of herbicides on forest land in Oregon. Whereas the methodology may appear profitable and practical, I hold that in the long run the damage to the health of wildlife, aquatic life, general forest health, and people will prove far more costly. A fifteen page warning off of a drum of herbicide that I read indicated that it could be harmful to wildlife including deer. I think that we are caught in a paradigm of tactics that fosters our use of herbicides and discourages the creative and inspirational thinking that is required in sound, sustainable forestry management.

We know very little of the long-term effects of herbicides and multiple exposures to varying toxins. Given the complexity of these compounds and the complexity of human, animal, and fish immune, endocrine, and other bodily systems under different conditions, jurisprudence would tell us that we are taking far too many risks. Experiments have indicated that exposures to EPA standards of "acceptable limits" of various herbicides or pesticides changed dramatically, when stress was introduced causing increased die-off of tadpoles. Other studies have shown that a single chemical exposure causes no harm, but multiple exposures again cause dramatic increases in tadpole die-off.**The simple, over-looked reality is the EPA, responsible for the endorsement of 80,000 chemicals, does not test them. They only assess the testing plans of the chemical companies and their proxies.

As our public agency, the ODF needs to:
1. Become just that--a public agency, responsive to the voice of the people, small landowners, and those concerned with the herbicide issue whose numbers are considerable state-wide.
2. Monitor the long-term effects on people, fish, and wildlife.
3. Get up to date with the current body of studies indicating the health effects of herbicides.
4. Encourage with incentives, innovative forestry techniques and experimentation.
5. Integrate planning of units occurring in the same watershed, minimizing impact.
6. Remember that children's susceptibility to toxins is many times greater than adults.

Thank you for your consideration.

Sincerely,

Richard Gross

**Scientific American, May10, 2006, "Mixing it Up", by David Biello

ID 68

First Name: Noah
Last Name: Greenwald
Email: ngreenwald@biologicaldiversity.org
Address1: PO Box 11374
City: Portland
State: OR
Zip: 97211
Company: Center for Biological Diversity
Title: Conservation Biologist
Phone: 503-484-7495
Contact by: E-Mail
Issue Description:

Conservation of biological diversity: Although Oregon Department of Forestry's proposed zone management will protect some habitat, there is a need for a more explicit consideration of conservation of biological diversity on state lands. In a comprehensive review of the status of species in northwest Oregon (http://www.biologicaldiversity.org/swcbd/library/TillamookReport.pdf), we determined that there are at least 215 species of concern in the area, many of which are threatened by logging, roads and other causes of habitat destruction.

In order to ensure that large numbers of these species are not driven to extinction or listed as threatened or endangered under the U.S. Endangered species Act, the Board of Foresty and ODF need to take several actions. First, ODF needs to identify and protect existing key habitats for species of concern, particularly small and large pockets of late-successional forest and key aquatic diversity areas. ODF estimates that less than 1% of existing state forest lands have late-successional characteristics. However, many stands have remnant trees or pockets of trees that provide late-successional characteristics. Given the limited distribution of late-successional habitatss on state lands, these remnants need protection. Similarly, key aquatic habitats that provide habtiat for fish, amphibians and invertebrates need to be identified and protected.

Second, ODF and BOF need to identify focal management species that guide management for biological diversity with a goal of ensuring that enough habitat is provided for viability of at least these focal species.

ID 69

First Name: Barbara
Last Name: Lee
Email: bjlee@odf.state.or
Address1: 2600 State St
City: Salem
State: OR
Zip: 97310
Company: State Forests Program
Title: Policy and Planning Manager
Phone: 503-945-7354
Contact by: E-Mail
Issue Description:

The program would like to work with the board to: identify possible improvements to the legal and decision-making framework associated with state forests management planning. These improvements would assure: timely and systematic evaluation of forest management plans; clear decision-making authorities at all levels; a legally sound framework. Additionally, the improvements would assure a clear link to the Board's recently adopted performance measures for the State Forest Program, and outline how the Program will respond to the Board's feedback on these measures.

ID 70

Dear Dan,

July 22, 2007

First, let me thank you for all you are doing to take care of our forests and for this opportunity for citizen input.

As I do the grunt work of planting, then watering, and releasing riparian zone trees and shrubs along the salmon-spawning creek that runs through my property, I watch the clearcutting and spraying all around me. This combination of clearcutting and chemical spraying of the native groundcover causes incredible erosion, and then sediment, together with chemicals, inevitably enters that same creek because of our steep slopes.

One clearcut has still not been replanted and it's been almost a year but it has been sprayed twice. No living thing grows there now. What is happening to the fungi, the microorganisms, the native groundcovers, and the animals that browsed on them?

Your research in 2000 found there are herbicides in the water 24 hours after spraying in as many as 15 % of your samples! Given the amazingly long half life of many popular herbicides, research **AFTER 24** hours also needs to be done as low levels of chemicals are known to have adverse effects on salmonids.

Please do the research to ensure your rules are truly effective in preserving habitat not just for land animals, (including humans!) but for the salmonids that were once so abundant in our watersheds. Everyone who loves salmon is a stakeholder in this endeavor, as we all share the need to eat, and there is increasing evidence that wild fish are healthier both for our watersheds AND for the consumer.

Given the 500 word limit, I'll list my concerns and suggestions below:

1) Monitor chemical drift, runoff & leaching in watersheds to ensure NO impact on fish, their food sources, or human health. To get baseline data for this research have those who've made the choice to use this form of weed control file a simple **postspraying statement** of **product, (including "inerts")amounts and date sprayed.**
2) Compare how clearcutting/spraying compares to thinning in their impact on erosion, endangered species, fire spread, spread of invasive species, forest workers' health, tourism, and soil and water health.
3) Are current fishbearing stream buffers adequate? Your own 2000 research says they're not as far as herbicides moving into water are concerned
4) Involve more of the public and local landowners who are impacted, as well as other stakeholder industries in our state (e.g. tourism, health care, forestworkers) in chemical herbicide use decision-making to ensure transparency, integrity, and sustainable stewardship prevail.

I wish you well as we all do our part in ensuring that healthy and beautiful forests with sustainable best practices logging will also result in watersheds so healthy that not only can commercial fishing resume, but tourists will, once again, come from throughout the world to fish here, as they did in the Siuslaw in the '20s.

Sincerely,

Mary J. Moffat

88197 Nelson Mtn Rd., Walton, OR 97490

ID 71

OREGON SOCIETY OF AMERICAN FORESTERS

4033 SW Canyon Road • Portland, OR 97221 • 503.224.8046

CHAPTERS: Blue Mountain • Capital • Central Oregon • Columbia Gorge • Coos • Emerald • John Day
Mary's Peak • Oregon State University • Portland • Shasta-Cascade • Siskiyou • Tillamook-Clatsop • Umpqua

July 26, 2007

To the Board of Forestry:

As Chair of the Policy and Legislation Committee of the Oregon Chapter of the Society of American Foresters (OSAF), I offer some comments for consideration in the Board's 2007 Issue Scan. Although this input does not reflect a formal survey of our members, it is based on feedback from a number of knowledgeable and experienced OSAF leaders who have a solid understanding of Oregon's forest lands and vital issues. Highlighted here are two issues that center on Oregon's forests and two that center on the Board's work and policy process:

ID 71

Management to Reduce Wildfire & Health Hazards:

This should be among the highest priorities for both public and private lands in Oregon. Clearly, there is an unprecedented need for active forest management to reduce wildfire, insect and disease hazards. These problems do not recognize property boundaries so require landscape-level strategies and actions to be sufficiently effective. The Board and the State should exert the bold leadership needed to promote the extensive and timely actions that will effectively address these problems on federal, state, local, and private forest lands alike.

Sustaining Working Forests:

ID 72 This is another issue that should be among the highest priorities for both private and public forests in Oregon. Working forests provide important socioeconomic benefits that help maintain local forest ownerships against competing land uses, while sustaining nearby communities and essential labor and infrastructure. Maintaining working forests over competing land uses also helps sustain a multitude of ecological benefits, including wildlife habitat, carbon sequestration, and favorable watershed conditions. Similarly, the management and use of renewable, recyclable, biodegradable, and energy conserving/producing forest products are imperative given increasing human needs and climate change and environmental sustainability concerns. The Board and the State should exert the bold leadership needed to promote policies that effectively support and sustain both private and public working forests in Oregon.

ID 73 Enhancing Board Accomplishments:

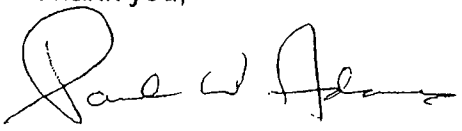
The current work plan is extensive and highly ambitious for a Board comprised of volunteer members. Although the ODF provides substantial technical and administrative support, the Board should recognize its own limitations and more clearly prioritize and focus its efforts. Similarly, Board discussion and decision-making should be streamlined when necessary to maintain clear and timely progress on priority issues. Lacking this focus and streamlining, Board function at times has begun to resemble the inertia that has plagued federal planning and decision-making.

ID 74 Forestry Professionals as Stakeholders:

The Board often seeks input and advice from stakeholders when evaluating forest issues and related policies. Yet forestry professionals are not often invited to provide their professional perspective *independent of their employer or client interests.* The result is missed opportunities to tap highly relevant and diverse expertise and experience, as well as a limited voice for those who must deal directly with policies that may be developed lacking the unique insights of this key professional community. The OSAF is most capable and willing to provide such vital stakeholder representation and advice to the Board, but to date we have not been specifically invited to do so.

I hope that these few comments are helpful and constructive. Please do not hesitate to contact me or OSAF via www.forestry.org if you have any questions or other needs related to this input.

Thank you,



Paul W. Adams, PhD, Certified Forester
Chair, Policy & Legislation Committee, Oregon Society of American Foresters

E-mail: adamspvkt@comcast.net
Mailing address: 4215 SW Brooklane Drive, Corvallis, OR 97333

ID 75

First Name: Zac
Last Name: Zuppas
Email: zzuppas@yahoo.com
Address1: None
City: Dillard
State: OR
Zip: 97496
Company:
Title:
Phone: 555-555-5555
Contact by: E-Mail
Issue Description:

As any Oregonian, I am appalled at the site of the clear cuts. I am staying neer dillard and I have yet met a resident that does not feel that the clear cuts are also causing cuts into their hearts. I feel that the way the forest is treated is akin to the way the native americans were systematically cut down until now they are only found on reservations and there is nothing left of their ways and culture but a toxic form. I, nor anyone else, wants to see th is happen to the old growth forests. We all now in our hearts that the replanted forest is not the same. Take a walk in each if you do not. I am proposing that the board make a timeline to phase into a truly sustainable forest plan and take the first step toward such a way of operation. There is no more time to research this and there is no time like the present to act. I know I speak for the majority of oregonians and all Amercians that are watching in horror. If you don't agree, take a survey. Thanks for listening and know that the choice that spreads love and peace is the right choice. Thank you.

ID 76

First Name: Carla
Last Name: Hervert
Email: chervert@ohvi.org
Address1: 2948 Dry Creek Rd.
City: Eugene
State: OR
Zip: 97404
Company:
Title:
Phone: 541-688-5903
Contact by: E-Mail
Issue Description:

I am writing today to ask that ODF give high priority to chemical monitoring regarding pesticides- not a low priority as current.

We are just beginning to study and document potential health hazards, neurological problems from exposure to pesticides, and various chemicals. There are so many chemicals used, that we don't know long term effects. Especially in younger populations, children, when their neurological and immune systems are developing.

I am desperately requesting that ODF research chemical drift from aerial applications on forested lands to surrounding communities. I have met and spoke with folks who have become ill (nauseated, shakey) a few hours after an aerial spray occurred. We have laws for buffer zones to protect salmon, but not for humans. Thank you for your time and consideration. Carla Hervert

ID 78

First Name: Lisa
Last Name: Arkin
Email: larkin@oregontoxics.org
Address1: PO BOX 1106
City: Eugene
State: OR
Zip: 97440
Company: Oregon Toxics Alliance
Title: Executive Director
Phone: 541-465-8860
Contact by: E-Mail
Issue Description:

On behalf of the hundreds of members and involved individuals of the Oregon Toxics Alliance, I urge the Oregon Board of Forestry to identify the use of herbicides in our forests as a priority issue for their upcoming 2008work plan. Four issues related to pesticides include:

ED 77 1. Gather scientific data and review the latest research on aerial pesticide application and resulting drift. For example, Dr. Paul Engelking testified before the Oregon Legislature about his research on drift and the extent to which pesticide droplets and mist are capable of traveling far off target. The Board must do more to monitor the fate of off-target herbicides. The impacts of drift on rural residents and their personal property and domesticated animals should be included. Complaints received by the Oregon Department of Agriculture and even the Oregon Toxics Alliance reveal evidence of pesticide drift that has harmed, and in some cases even killed, farm animals. Furthermore, serious consideration must be given to the impacts of drift on the growing numbers of organic farms located in the vicinity of commercial forestland. One prominent organic vineyard has contacted us repeatedly about concern with pesticide drift which potentially could put their organic certification in jeopardy.

ED 78 2. ODF must partner with the DEQ to conduct bio-monitoring of deer, fish and amphibian populations. It is imperative to gather data on the possible uptake of chemicals by the animals that inhabit the forest and the water bodies therein. Furthermore, ODF and DEQ should expand programs of water quality testing in small streams, ponds and springs (in addition to ongoing river monitoring). Any water sources that serve as drinking water for rural residents should be consistently monitored.

ID-79 3. Pesticide use is now recognized as an air quality issue in some states. The EPA is about to lower the ozone

standard (and recently lowered the standard for particulate matter). ODF and the Board of Forestry should also look at the issue of how the application of aerial herbicides and fertilizers can contribute to air quality problems. We should all be concerned that Oregon's rates of asthma and chronic lung disease are increasing dramatically and this is not restricted to urban residents.

FD 80

4. Oregon Toxics Alliance is also deeply concerned about the lack of balanced representation from environmental, public health, and conservation organizations on the Board of Forestry and affiliated committees, "stakeholder" groups, advisory boards. There should be at least one (if not more) representatives from each sector- environmental, public health and conservation interests. It is also equitable to include a forester who has a track record in non-chemical, selected harvest practices to serve on decision-maker boards and committees. Rural residents who live next to forestry operations should also be considered as stakeholders in forestry decisions and included as such.

First Name: Laura
Last Name: Stockford
Email: Laurastockford@comcast.net
Address1: Post Office Box 2632
City: Eugene
State: OR
Zip: 97402
Company:
Title:
Phone: 5417298385
Contact by: Postal Mail
Issue Description:

Please give HIGH PRIORITY to Chemical Monitoring, if affects the health of our children and our environment.

Thank-you

Laura Stockford

Ib 82

First Name: rob
Last Name: freres
Email: rtfreres@frereslumber.com
Address1: pob 276
City: lyons
State: or
Zip: 97358
Company: freres lumber co.inc.
Title: exec. v.p.
Phone: 503 859 2121
Contact by: E-Mail
Issue Description:

Ib 82 please allow the use of pesticides and herbicides to enhance forest management with minimal interference by the agency.

ID 83 provide an inventory of available biomass from the Santiam Forest as provided by law.

ID 84 Discontinue the structure based management plans now in effect.

-0 85 Discontinue the duplicitious spotted owl protections.

ID 86

First Name: Michelle
Last Name: Saxton
Email: michellesaxto@yahoo.com
Address1: 3820 E. 22nd Ave.
City: Eugene
State: Oregon
Zip: 97403
Company:
Title: Ms.
Phone: 541-342-4522
Contact by: E-Mail
Issue Description:

I would propose that the ODF needs to better monitor aerial spraying near landowners and neighboring property. I believe these pesticides cause long term respiratory problems especially among children and the elderly.

I would like better monitoring of spraying near homeowner and neighboring properties and more research on long term effects of spraying.

I have Asthma my daughter has some sort of autism spectrum disorder we both have serious allergies. I am inconclusive of whether this is caused by spraying. I would like the state and federal agencies to work together to collect more data on aerial spraying.

From: Patton, Tally [mailto:Tally.Patton@weyerhaeuser.com]
Sent: Friday, July 27, 2007 8:25 AM
To: POSTREL Dan
Subject: Issue Scan

Dan.,
I am going to demonstrate my ignorance, but I was unable to find the form for input into the issues scan. I have waited to the last possible moment to enter my ideas. Therefore the following issues should be added the your list:

ID 87

Control of information that allows access to private information ie names and personal addresses and phone numbers that can be attained through notification process that is put on the web. Also the accidental listings of unlisted phone numbers through Web listings of the Department of Forestry. With the amount of access that is available through internet quasi private information is too accessible. The intent of the notification process was to provide a link to the public to ask questions not to have the personal data so easily available to anyone. Board needs to address the change that internet has posed with information obtained in the notification process.

ID 88

Differetiate the identification and descrition of cultivated wetlands and forested wetlands as it pertains to required protections

ID 89

Definition of noxious weed control as to an forest operation or noxious weed control and when a notification is needed.

Tally

Tally Patton
Forester
(541)744-4648
P.O. Box 1819
Eugene, OR 97440

ID 90

First Name: Jennifer
Last Name: Weikel
Email: jweikel@odf.state.or.us
Address1: 2600 State St.
City: Salem
State: OR
Zip: 97310
Company: ODF
Title: Fish and Wildlife Specialist
Phone: 503-945-7476
Contact by: E-Mail
Issue Description:

Forest Practices Act (FPA) significant wetland rules (OAR 629-645) defines a significant wetland primarily based on size (> 8 acres); ecological value is not considered when determining whether or not a potential wetland qualifies for Forest Practices Act protections. The definition of "wetland" in the FPA rules is the same as used by the Corps of Engineers. Thus although it is not specified in the rules how ODF should identify and delineate wetlands, as a standard operational practice ODF has been using the criteria specified in the Corps' "Field Guide for Wetland Delineation" to determine whether or not an area qualifies as a wetland. While the Corps' criteria works well for functioning and forested wetlands (e.g., ash swales), Stewardship Foresters run into difficulties for "atypical situations".

In many locations in Oregon, large areas of wetlands have been converted for agricultural use; most are used for grazing cattle and/or growing hay. These farmed wetlands are often ponded or flooded during the winter months and into the spring, thus although the vegetation has been altered they still meet the technical definition of a wetland and are subject to regulations imposed by the Corps of Engineers and Division of State lands (DSL). As such, ODF has also been treating farmed wetlands that exceed eight acres in size as "Significant Wetlands" and have been requiring forested buffers in order to ensure compliance with the Forest Practices Act. This creates a difficult situation for ODF Stewardship Foresters when they have to tell a landowner that they need to retain trees for the purposes of protecting their "cow pasture". Questions often arise as to the values and functions that are being protected and the ecological role that the retained trees

play. Unfortunately, this is difficult to support when the "wetland" is being heavily used for agriculture purposes.

The issue of FPA significant wetland protections on agriculture wetlands has been long-standing within the department. This is not a small-scale issue as there are many miles of interface between forest and agriculture wetlands, especially along the coast, in inland valleys (e.g. Lane County), and in valleys of the Klamath region. The issue was a major topic at the Southern Oregon Area Stewardship Forester Conference in December of 2005 and at that time the Department indicated that they work to seek a resolution to the issue. Due to turn-over in staff as well as work-load issues, the issue was not addressed and no resolution has been determined.

I recommend that the issue of clarifying the significant wetland rules be added to the Forest Regulations work plan. The Board of Forestry may need to be directly involved as this will likely be a complicated issue potentially requiring either 1) clarification of the intent and scope of the of significant wetland rules by the Board of Forestry or 2) a Board decision to change the significant wetland rules.

ID 91

From: Harold Codman [mailto:hcodman@comcast.net]
Sent: Tuesday, July 24, 2007 9:06 PM
To: information
Cc: Lisa Arkin
Subject:

To whom it may concern

It has been brought to my attention that ODF has been lax in monitoring the effects that the pesticides that you allow to be used in our forests have on wildlife and nearby human life. Neighboring states have taken up this issue and I think you should too.

Sincerely

Harold Codman

1557 Braeman Vlg

Eugene OR 97405

ID 92

The highest priority issues for the next 2 years for the BOF should be the conversion of forest land 1) from managed for forest purposes (from timber harvest to wildlife habitat) to managed for housing and other development (under concrete forevermore), and 2) from current, diverse ownership patterns to less diverse patterns.

We have been "fat and happy", relying on our land use regulations to project prime forest land form concrete, and have felt smug as we watched the development going on in WA and CA. But our land use laws are feeling the pressure of development and we must take affirmative action to preserve our forest land base.

I have noted a tremendous shift in ownership in the last few years from family forest landowners to industrial and/or TIMO landowners. This may not be all bad for forest vitality. But family owners are very valuable to our forest landscapes, and it concerns me greatly as these owners age and sell off their property for a variety of reasons. Diversity in owners and in management should be recognized as vital to long-term stability in our forest base, so less diversity should be cause for concern.

These issues seem to fit under your Forest Vitality category, and I hope you will see fit to jet them to the top of your list.

Board of Forestry - 2007 Issue Scan

Printed Name: SARA A. LEIMAN
Affiliation: family forestland owner - family business.
Mailing Address: 26240 CHERRY CREEK RD
MONROE, OREGON 97456

ID 93

Dear Dan Postel, July 25th 07

I am writting you this letter to ask you to PLEASE help our Communities by putting the Herbacide/Perticide-Poison's Monitoring on the #1 Priority, in the name of LIFE and God's Creation!

Please understand the pains of our Communities caused by Chemical drift inhalation via air (our primal food), the persistance of dioxins (chemical by-products) in soil, air (moved on pollen – scientific fact), and water. Our bodies are built on Elements and when these are toxic, then our bodies become toxic, sickness and suffering pain, miscarriages, cancer, and many more autoimune dis-eases occur. Please, in the name of our Creator have Compassion. I know you have a hard job ahead, because the ones that benefit this are Chemical companies that even finance their scientific researches for their own products. However there are LIGHT & TRUTH serving Scientists that only speak the Truth. I have included scientific factsheets that show how toxic these substances are Please take time to study them and see the importance to step onto the side of LIGHT, not darkness, for after all hurting "another" is only hurting oneself! See on the back page how many gallons of these toxins ended up in Mc Kenzie Watershed to the math when those gal are multiplied by thousands of acres that gets poisoned each year. Please do good in the name of God! Sincerly

TABLE 1
Forest Pesticide Application by Chemical Type
McKenzie Watershed, 2006

Chemical	Active Ingredient	Total Gallons	Total Acres Treated
2,4-D, LV6	2,4-D	252	25
Accord Concentrate	Glyphosate	1,074	3,466
Accord XRT	Glyphosate	1,105	2,013
Activator 90	NA (Adjuvant)	35	142
Arsenal	Imazapyr	28,074	26,914
Chopper	Imazapyr	567	5,098
Crop Oil	NA (Adjuvant)	66,616	24,604
Escort	Metsulfuron Methyl	8	1,064
Forester	Unknown	138	277
Garlon 4	Triclopyr	8,513	25,291
Garlon3A (Triclipyr Amine)	Triclopyr	167	287
Glyphosate	Glyphosate	376	474
Hasten Oil	NA (Adjuvant)	1,754	921
Herbimax	NA (Adjuvant)	5	43
Induce	Unknown	56	527
LI 700	NA (Adjuvant)	50	474
Liberate Surfactant	NA (Adjuvant)	78	474
Moract	NA (Adjuvant)	70	844
MSO/Method Surfactant	NA (Adjuvant)	1,152	1,371
Oust	Sulfometuron	71	1,085
Oust Extra	Sulfometuron	44	1,411
Phase Surfactant	NA (Adjuvant)	16	638
Serine	Triazine	11	142
Transline	Clopyralid	5	14
Urea	Nitrogen Fertilizer	2,106	41
Velpar DF	Hexazinone	5	14
Grand Total		112,350	97,655

From: Maya Hoos
18964 Little Cave Rd
Blachly, OR 97412

● HERBICIDE FACTSHEET

GLYPHOSATE

Glyphosate herbicides (one common brand name is Roundup) are the mostly commonly used herbicides in the U.S. and the world. In agriculture they are widely used with genetically-modified glyphosate-tolerant crops, but they are also widely used in yards, gardens, and other nonagricultural areas.

Symptoms of exposure to glyphosate include eye irritation, burning eyes, blurred vision, skin rashes, burning or itchy skin, nausea, sore throat, asthma and difficulty breathing, headache, lethargy, nose bleeds, and dizziness.

Glyphosate and glyphosate-containing herbicides caused genetic damage in laboratory tests with human cells, as well as in tests with laboratory animals.

Studies of farmers and other people exposed to glyphosate herbicides have shown that this exposure is linked with increased risks of the cancer non-Hodgkin's lymphoma, miscarriages, and attention deficit disorder. For each of the hazards identified in these studies there are also laboratory studies with results that are consistent with the studies of exposed people.

There is also laboratory evidence that glyphosate herbicides can reduce production of sex hormones.

Studies of glyphosate contamination of water are limited, but new results indicate that it can commonly contaminate streams in both agricultural and urban areas.

Problems with drift of glyphosate herbicides occur frequently. Only one other herbicide causes more drift incidents.

Glyphosate herbicides caused genetic damage and damage to the immune system in fish. In frogs, glyphosate herbicides caused genetic damage and abnormal development.

Application of glyphosate herbicides increases the severity of a variety of plant diseases.

BY CAROLINE COX

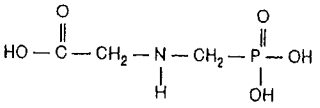
Glyphosate (see Figure 1) herbicides are "among the world's most widely used herbicides."[1] and glyphosate is "the world's leading agrochemical."[2]

Although glyphosate herbicides have been popular since they were first marketed in 1974, their use in agriculture has expanded recently with the increased use of crops that have been genetically modified to tolerate glyphosate treatment.[3]

Roundup is a popular brand name for glyphosate herbicides,[1] although many other brand names are used.[4]

Glyphosate is marketed in more than 100 countries by a variety of manufacturers, but Monsanto Company has been and continues to be the major commercial supplier worldwide.[3]

Figure 1
Glyphosate



N-(phosphonomethyl)glycine

Use Estimates

The U.S. Environmental Protection Agency (EPA) recently estimated that annual use of glyphosate in the U.S. is between 103 and 113 million pounds.[5]

Glyphosate is used more than any other pesticide. It is the most commonly used agricultural pesticide, and the second most commonly used pesticide around and in homes and gardens. Home and garden use totals over 5 million pounds per year.[5]

According to Monsanto Company, there are more approved uses for glyphosate than for any other herbicide.[1]

How Does Glyphosate Kill Plants?

Glyphosate blocks the activity of an enzyme used by plants to make certain important amino acids. Without these amino acids, the plant cannot make proteins required for various life processes, resulting in the death of the plant.[1,6]

Glyphosate is a broad spectrum herbicide, so it kills most types of plants.[6]

Overview

It is often said that "there is no indication of any human health concern"[4] for glyphosate and that glyphosate "is virtually nontoxic to mammals, birds, fish, insects, and most

■

Caroline Cox is NCAP's staff scientist.

NORTHWEST COALITION FOR ALTERNATIVES TO PESTICIDES/NCAP
P.O. BOX 1393, EUGENE, OREGON 97440 / (541)344-5044 / www.pesticide.org

bacteria."[7] However, this herbicide can actually pose significant hazards to human and environmental health. This article summarizes the research documenting those hazards, with a focus on research published since 2000.

Inert Ingredients

Like most pesticides, commercial glyphosate herbicides contain ingredients other than glyphosate which, according to U.S. pesticide law, are called "inert."[8] Publicly available information about the identity of these ingredients in glyphosate products is incomplete.

For information about the hazards of some of the inert ingredients in commercial glyphosate products, see "Inert Ingredients," at right.

Research studies about glyphosate sometimes use commercial glyphosate herbicide products, and other times use glyphosate alone. In this article we identify as accurately as possible which was used in each study discussed.

Symptoms of Exposure

According to reports made to the California Pesticide Illness Surveillance Program, symptoms of exposure to glyphosate herbicides include eye irritation and inflammation, burning eyes, blurred vision, skin rashes, burning or itchy skin, nausea, sore throat, asthma and difficulty breathing, headache, lethargy, nose bleed, and dizziness.[9]

"Irritation" can seem like a less serious symptom than those caused by other pesticides. However, it can be significant. For example, Italian dermatologists in 2004 reported treating a patient who knelt on the ground where her son had just sprayed a glyphosate-containing herbicide. She then put on clothing that had been on the ground where he had sprayed and napped. Within hours her skin was burning and she developed a blistering rash on her back, legs, and feet that lasted for a month.[10,11]

Ability to Cause Genetic Damage (Mutagenicity)

Four laboratory studies published in the late 1990s demonstrated the ability of glyphosate and glyphosate-containing herbicide products to cause

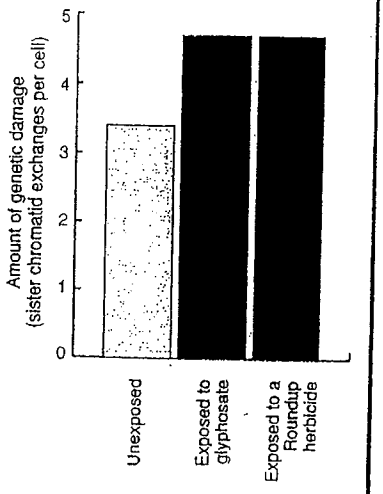
"Inert" Ingredients in Glyphosate Herbicides

Inert ingredients in commercial glyphosate herbicide products, with examples of their hazards, include the following:

- **5-Chloro-2-methyl 3(2H)-isothiazolone**[1] caused genetic damage and allergic reactions in laboratory tests.[2]
- **FD&C Blue No. 1**[1] caused genetic damage and skin tumors in laboratory tests.[3]
- **Glycerine**[1] caused genetic damage in tests with human cells and laboratory animals. It also reduced fertility in laboratory tests.[4]
- **3-Iodo-2-propynyl butyl carbamate**[1] caused thyroid damage and decreased growth in laboratory tests.[5]
- **Light aromatic petroleum distillate (Chemical Abstract Services No. 64742-95-6)**[1] reduced fertility and growth of newborns in laboratory tests.[6]
- **Methyl p-hydroxybenzoate**[1] caused genetic damage in laboratory tests.[7]
- **Polyoxyethylene alkylamine**[1] is an eye irritant.[8] It is also toxic to fish.[9]
- **Propylene glycol**[1] caused genetic damage, reduced fertility, and anemia in laboratory tests.[10]
- **Sodium sulfite**[1] caused genetic damage in tests with both laboratory animals and human cells.[11]
- **Sodium benzoate**[1] caused genetic damage in tests with human cells and laboratory animals. It also caused developmental problems and reduced newborn survival in laboratory tests.[12]
- **Sodium salt of o-phenylphenol**[1] is a skin irritant. It also caused genetic damage and cancer in laboratory tests.[13]
- **Sorbic acid**[1] is a severe skin irritant and caused genetic damage in laboratory tests.[14]

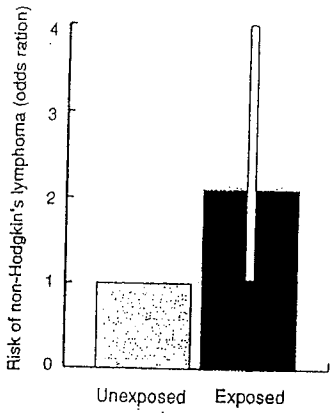
1. U.S. EPA. Office of Prevention, Pesticides, and Toxic Substances. 2004. Response to Freedom of Information Act request of October 19, 2004. Washington, D.C. Response dated November 17.
2. National Institute for Occupational Safety and Health. 2003. RTECS: 4-Isothiazolin-3-one, 5-chloro-2-methyl-. www.cdc.gov/niosh/rtecs/nx7c76b2.html.
3. National Institute for Occupational Safety and Health. 2000. RTECS: Ammonium, ethyl (4-(p-(ethyl(m-sulfobenzyl)amino)-alpha-(o-sulfophenyl)benzylidene)-2,5-cyclohexadien-1-ylidene)(m-sulfobenzyl)-, hydroxide, inner salt, disodium salt. www.cdc.gov/niosh/rtecs/bq481908.html.
4. National Institute for Occupational Safety and Health. 2003. RTECS: Glycerol. www.cdc.gov/niosh/rtecs/ma7ad550.html.
5. U.S. EPA. Prevention, Pesticides and Toxic Substances. 1997. Reregistration eligibility decision (RED): 3-Iodo-2-propynyl butylcarbamate (IPBC). www.epa.gov/pesticides. p.7.
6. National Institute for Occupational Safety and Health. 1996. RTECS: Solvent naphtha (petroleum), light aromatic. www.cdc.gov/niosh/rtecs/wl33e140.html.
7. National Institute for Occupational Safety and Health. 2003. RTECS: Benzoic acid, p-hydroxy-, methyl ester. www.cdc.gov/niosh/rtecs/dh256250.html.
8. National Institute for Occupational Safety and Health. 1997. RTECS: Ethomeen T/15. www.cdc.gov/niosh/rtecs/ko92dda8.html.
9. W.T. Haller and Stocker R.K. 2003. Toxicity of 19 adjuvants to juvenile *Lepomis macrochirus* (bluegill sunfish). *Environ Toxicol Chem.* 22:615-619.
10. National Institute for Occupational Safety and Health. 2003. RTECS: 1,2-Propanediol. www.cdc.gov/niosh/rtecs/ty1e8480.html.
11. National Institute for Occupational Safety and Health. 2003. RTECS: Sodium sulfite. www.cdc.gov/niosh.rtecs/we20ce70.html.
12. National Institute for Occupational Safety and Health. 2003. RTECS: Benzoic acid, sodium salt. www.cdc.gov/niosh/rtecs/dh657890.html.
13. National Institute for Occupational Safety and Health. 2003. RTECS: 2-Biphenylol, sodium salt. www.cdc.gov/niosh/rtecs/dv757e20.html.
14. National Institute for Occupational Safety and Health. 1998. RTECS: Sorbic acid. www.cdc.gov/niosh/rtecs/wg200b20.html.

Figure 2
Ability to Cause Genetic Damage in Human Blood Cells



Source:
Bolognesi, C. et al. 1997. Genotoxic activity of glyphosate and its technical formulation Roundup. *J. Agric. Food Chem.* 45:1957-1962.

Figure 3
Ability to Cause Cancer



Note: Line on and above bar is a 95% confidence Interval.

Source:
De Roos, A.J. et al. 2003. Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men. *Occup. Environ. Med.* 60(9):E11.

Exposure to glyphosate herbicides has caused genetic damage in laboratory tests, and use of glyphosate by farmers is associated with an increased incidence of lymphoma.

genetic damage.[12-15]

Two of the studies, both done by scientists at Italy's Instituto Nazionale per la Ricerca sul Cancro exposed mice to glyphosate and a Roundup herbicide by injection.[12,13] One study also exposed human blood cells to the same chemicals.[12] The first study showed that in mice both glyphosate and the Roundup herbicide damaged DNA (the genetic material in cells) in the liver and kidney and caused a different kind of genetic damage in bone marrow cells. Both substances also caused a third type of genetic damage in human blood cells. (See Figure 2.) In general, the Roundup used in these experiments was more potent than glyphosate.[12] The second study showed that a Roundup herbicide damaged DNA in the liver and kidney of mice.[13]

The other two studies were done at the Universita della Basilicata (Italy). Both used blood cells, one from cows and the other from humans. Both showed that glyphosate caused a significant increase in the number of abnormal chromosomes.[14,15]

A more recent (2004) study from the Institute of Biology and Environmental Sciences (Germany) showed that DNA damage occurred in human connective tissue cells[11] when they were exposed to glyphosate and hydrogen peroxide, a molecule that is commonly found in living things.[16]

The National Institute for Occupational Safety and Health describes glyphosate as a "mutagen."[17]

Ability to Cause Cancer (Carcinogenicity)

Three recent studies have demonstrated a link between glyphosate exposure and non-Hodgkin's lymphoma, a type of cancer:[18-20]

- A 2001 study of Canadian men showed that the risk of non-Hodgkin's lymphoma for men exposed to glyphosate more than two days per year was two times greater than the risk for men who were either unexposed or exposed for less than two days per year. The study was conducted at the University of Saskatchewan (Canada).[18]
- A 2002 study of Swedish men showed that glyphosate exposure was significantly associated with an increased risk of non-Hodgkin's lymphoma. The study was conducted by oncologists at Örebro University (Sweden).[19]
- A 2003 review of three earlier studies of Midwestern farmers showed that exposure to glyphosate was associated with an increased incidence of non-Hodgkin's lymphoma. The studies were conducted by the National Cancer Institute.[20] (See Figure 3.)

A fourth study, an analysis of results from the Agricultural Health Study, did not find an association between non-Hodgkin's lymphoma and glyphosate exposure. However, the incidence of another cancer, multiple myeloma, showed a "suggestive association" with glyphosate exposure. The Agricultural Health Study is sponsored by the National Institutes of Health and EPA.[21]

Several mechanisms by which glyphosate herbicide exposure could cause cancer have recently been identified. Researchers at the University of Minnesota found that both glyphosate and Roundup caused a rapid increase in cell division[11] in human breast cancer cells.[22] In addition, scientists at the Centre National de la Recherche Scientifique (France) showed that five glyphosate-containing herbicide products disrupted cell division in sea urchin embryos, which are commonly used as a model system for studying cell division. The type of disruption found in this study is "a hallmark of tumor cells and human cancers."[23]

EPA classifies glyphosate as a Group E pesticide. This classification means that the agency has found "evidence of non-carcinogenicity for humans."[24]

Effects on Pregnancy

Glyphosate exposure has been linked to increased risks of miscarriages

(spontaneous abortions).[11] In a study of Ontario, Canada farm families, glyphosate use in the three months prior to conception was associated with an increased risk of late (between the 12th and 19th weeks of pregnancy) miscarriages. (See Figure 4.) The study was conducted by researchers from Health Canada and Carleton University (Canada).[25]

Glyphosate-containing herbicides have also caused pregnancy problems in laboratory tests. In a 2003 study conducted by scientists from two Brazilian universities, a Roundup herbicide fed to pregnant rats during the middle part of their pregnancy caused an increase in the number of offspring with abnormal skeletons. The increase in abnormalities was significant at all dose levels tested in this experiment.[26]

Effects on Hormones

Hormones are chemical messengers that regulate all biological processes, including the reproductive system.[27]

Scientists at Texas Tech University studied the effect of a glyphosate-containing herbicide on hormone production. They looked at hormone production by Leydig cells, located in the testes, because these cells "play a crucial role in male reproductive function." The scientists showed that exposure to a Roundup herbicide reduced sex hormone production in these cells by 94 percent.[28] (See Figure 5.)

Association with Attention Deficit Disorder

Exposure of parents to glyphosate has been linked with an increased incidence of attention deficit disorder in children. A 2002 study conducted by researchers at the University of Minnesota found "a tentative association between ADD/ADHD [attention deficit disorder] and use of this herbicide"[29] by Minnesota farm families.[29]

The results of two laboratory studies are consistent with the results of the University of Minnesota study in that they show glyphosate and glyphosate herbicides cause brain and nerve damage. One study, conducted at the Universidad Nacional de San Luis (Argentina) showed that feeding pregnant rats glyphosate-contaminated water caused changes in the activity of several enzymes in the brains of their fetuses.[30] A second study, from the University of Liverpool (United Kingdom) showed that Roundup exposure inhibited the growth and development of nerve cells.[31]

Soil Persistence

Glyphosate's persistence in soil varies widely. According to data compiled by the USDA's Agricultural Research Service, glyphosate's half-life varies from 2 to 174 days.[32] (The half-life is the amount of time required for half of the applied glyphosate to break down or move away from the treatment area.)

Contamination of Water

Glyphosate is not included among the pesticides being studied by the U.S. Geological Survey's (USGS's) National Water-Quality Assessment Program,[33] so there are no comprehensive national statistics about contamination of rivers and streams by glyphosate.

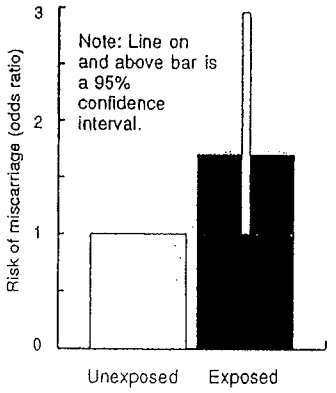
A regional study, however, indicates that glyphosate can be a common contaminant. In a USGS Toxic Substances Hydrology Program survey of Midwest streams in 2002, glyphosate was found in over a third of the samples collected. The primary breakdown product of glyphosate was found in over two-thirds of the samples. The study also showed that glyphosate contaminated water from spring through fall and described glyphosate in samples taken at harvest time as "unexpected"[34] because researchers had "presumed that glyphosate would degrade by this late in the growing season."[34]

USGS has also found glyphosate contamination in a study of urban streams in King County, Washington. Glyphosate was found in all six streams that were tested in this study.[35]

Drift

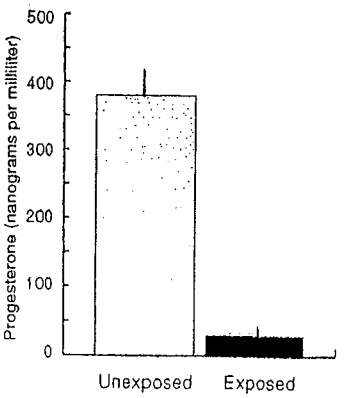
Drift incidents involving glyphosate are common. In 1999, the American Association of Pesticide Control Officials surveyed state pesticide regulatory

Figure 4
Ability to Cause Miscarriages



Source:
Arbuckle, T.E., L.Lin, and L.S. Mary. 2001. An exploratory analysis of the effect of pesticide exposure on the risk of spontaneous abortion in an Ontario farm population. *Environ. Health Persp.* 109:851-857..

Figure 5
Ability to Disrupt Sex Hormone Production



Source:
Walsh, L.P. 2000. Roundup inhibits steroidogenesis by disrupting steroidogenic acute regulatory (StAR) protein expression. *Environ. Health Persp.* 108:769-776.

Exposure to glyphosate herbicides is linked with an increase in the risk of miscarriage. In addition, a glyphosate herbicide reduced sex hormone production in a laboratory test.

agencies and asked which pesticides were most commonly involved in pesticide drift complaints. Glyphosate was the second most common pesticide; only the herbicide 2,4-D caused more complaints.[36]

Even the labels on glyphosate herbicides acknowledge drift problems. For example, the Roundup Pro label states "Avoid contact of herbicide with foliage, green stems, exposed nonwoody roots or fruit of crops, desirable plants and trees, because severe injury or destruction may result. Avoid drift. Extreme care must be used when applying this product to prevent injury to desirable plants and crops."[37]

Researchers at Carleton University (Canada) and Environment Canada who studied glyphosate drift describe its potential effects as "severe ecological changes."[38]

Effects on Birds

Glyphosate use can impact birds when the plants killed by the treatment are plants that birds use for food or shelter. Glyphosate treatment of forests after logging reduced the nesting success of songbirds, according to a study conducted by biologists at the University of British Columbia and the Canadian Wildlife Service.[39] According to reviews by the U.S. Geological Survey, treatment of cattail marshes with Rodeo (a glyphosate herbicide used in wet areas) has reduced populations of the marsh wren[40] and the sora.[41]

Effects on Fish

Glyphosate-containing herbicides can cause genetic damage in fish, and also disrupt their immune systems.

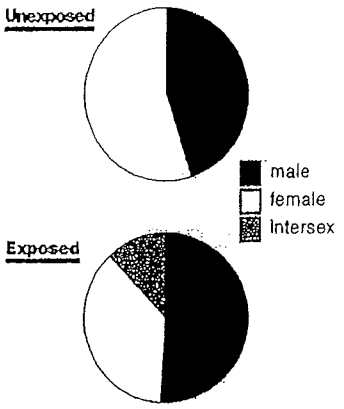
A study conducted at the Universidade de Brasília (Brazil) showed that injection of a Roundup herbicide in Tilapia increased damaged chromosomes in red blood cells.[42,43]

A study conducted at the University of Alexandria (Egypt) showed that exposure to Roundup reduced two measures of immune system function in spleen cells from Tilapia. The reduction occurred at all dose levels tested in this experiment.[44]

Effects on Insects

Glyphosate can cause genetic damage in insects. In a study of fruit flies, significant increases in mutations occurred when larvae were exposed to glyphosate during development. The experiment was conducted by researchers from Akdeniz University (Turkey) and the Universitat Autonoma de Barcelona (Spain).[45]

Figure 6
Effects on Sexual Development of Frogs



Source:
Howe, C.M. et al. 2004. Toxicity of glyphosate-based pesticides to four North American frog species. *Environ. Toxicol. Chem.* 23:1928-1938.

Exposure to glyphosate herbicides caused tadpoles to develop with abnormal sex organs.

Effects on Spiders

Spider populations can be reduced by herbicide treatment when the herbicide kills the vegetation they use for shelter. An experiment conducted by zoologists from Oxford University and the Royal Agricultural College (United Kingdom) looked for this kind of effect in the edges of agricultural fields. These margins "play an important agricultural role in providing a refuge for beneficial invertebrate predators"[46] which prey on pest insects in the fields. The zoologists found that treatment with a Roundup herbicide reduced spider numbers by over 50 percent.[46]

Effects on Frogs

Glyphosate herbicides can harm amphibians in a variety of ways, including causing genetic damage and disrupting their development.[47-49]

A 1997 study showed that a Roundup herbicide caused damage to DNA (genetic material) in bullfrog tadpoles. The University of Windsor (Canada) biologists who conducted the study concluded that its "genotoxicity at relatively low concentrations" was of concern.[47]

A 2003 study showed that a glyphosate-containing herbicide caused both mortality and malformations of a common neotropical tadpole. The study was conducted by scientists at three research institutes in Argentina.[48]

A 2004 study showed that "environmentally relevant" concentrations of several Roundup herbicides caused a common North American tadpole not to grow to its normal size and to take longer than normal to develop. In addition, between 10 and 25 percent of the Roundup-exposed tadpoles were intersex (having abnormal sex organs). The study was conducted by biologists at Trent University, Carleton University, and the University of Victoria (Canada).[49] (See Figure 6.)

Plant Diseases

Use of glyphosate herbicides has been linked to increased problems with a variety of plant diseases.

For example, glyphosate herbicides increased the severity of fusarium head blight in cereal crops,[50] the severity and frequency of sudden death syndrome in soybeans,[51] the severity of Pythium root rot in sugarcane,[52] and the severity of white mold in soybeans.[53]

These studies were conducted by scientists at Agriculture and Agri-Food Canada, Iowa State University, Louisiana State University, and Michigan State University.[50-53]

Resistance

Resistance is the "inherited ability of a plant to survive and reproduce following exposure to a normally lethal dose of herbicide."[54] The development of herbicide resistance is an increasing problem worldwide.[55]

The first glyphosate-resistant weeds were reported in 1996 in Australia. There are now 6 glyphosate-resistant weeds reported from 7 countries.[56]

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● HERBICIDE FACTSHEET

TRICLOPYR

Triclopyr is a broadleaf herbicide used primarily on pastures, woodlands, and rights of way. Garlon 3A and Garlon 4 are brand names of common triclopyr herbicides. Two forms of triclopyr are used as herbicides: the triethylamine salt (found in Garlon 3A) and the butoxyethyl ester (found in Garlon 4) .

The amine salt of triclopyr is corrosive to eyes. Both the amine salt and the ester are sensitizers and can cause allergic skin reactions.

In laboratory tests, triclopyr caused an increase in the incidence of breast cancer as well as an increase in a type of genetic damage called dominant lethal mutations. Triclopyr also is damaging to kidneys and has caused a variety of reproductive problems.

The ester form of triclopyr is highly toxic to fish and inhibits behaviors in frogs that help them avoid predators. Feeding triclopyr to birds decreases the survival of their nestlings.

Triclopyr inhibits the growth of mycorrhizal fungi, beneficial fungi that increase plants' ability to take up nutrients. Triclopyr also interferes with one step in the process by which atmospheric nitrogen is transformed by microorganisms into a form that is usable by plants.

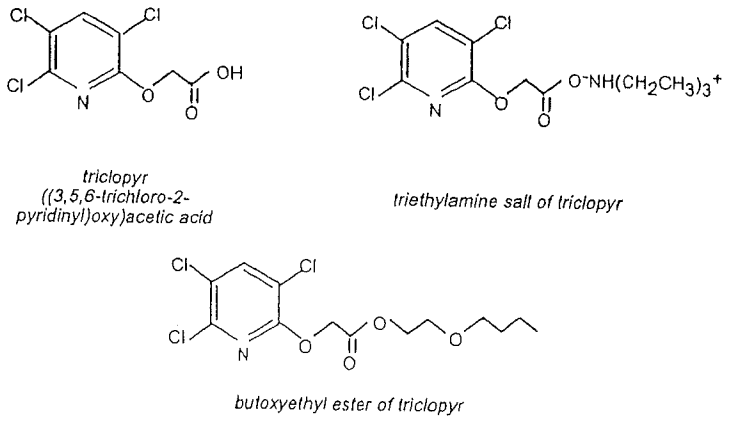
Triclopyr is mobile in soil and has contaminated wells, streams, and rivers. Contaminated water has been found near areas where triclopyr is used in agriculture, in forestry, on urban landscapes, and on golf courses.

The major breakdown product of triclopyr (3,5,6-trichloro-2-pyridinol) disrupts the normal growth and development of the nervous system. In laboratory tests, it also accumulates in fetal brains when pregnant animals are exposed.

BY CAROLINE COX

Triclopyr is a selective herbicide used to kill unwanted broadleaf plants. Triclopyr herbicides contain one of two forms of triclopyr, either the triethylamine salt or the butoxyethyl ester. (See Figure 1.) Triclopyr was first registered as a pesticide in the U.S. in 1979 and its major manufacturer is Dow AgroSciences.[1] It is sold under a variety of trade names, including Garlon 3A,[2] Garlon 4,[3] Pathfinder,[4] Remedy,[5] Turflon,[6] and (in Canada) Release.[7] Garlon 3A contains the triethylamine salt, the others contain the butoxyethyl ester.[2-7] Triclopyr is in the carboxylic acid chemical family.[8]

Figure 1
Triclopyr, Its Triethylamine Salt, and Its Butoxyethyl Ester



triclopyr ((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid

triethylamine salt of triclopyr

butoxyethyl ester of triclopyr

Use

According to estimates from the U.S. Environmental Protection Agency (EPA), use of triclopyr in the U.S. totals almost 700,000 pounds per year.[9] Pastures, woodlands, and rights of way account for almost three-quarters of this use while rice is the major agricultural use.[9] An estimated 455,000 applications are made annually to U.S. lawns and yards.[10]

■

Caroline Cox is NCAP's staff scientist.

How Does Triclopyr Kill Plants?

Triclopyr imitates a plant hormone called indoleacetic acid, one of a number of plant hormones classified as auxins. Triclopyr causes the growing tips of the plant to elongate, followed by distortion, withering, and the death of the plant.[8]

Triclopyr is selective (most toxic to broadleaf plants) because grasses are quickly able to transform triclopyr into compounds that do not have hormonal activity.[11]

"Inert" Ingredients in Triclopyr-Containing Products

According to U.S. pesticide law, any ingredients in triclopyr herbicides other than triclopyr are called "inert."[12] Except for acute toxicity testing, all toxicology tests required for registration as a pesticide were conducted with triclopyr, not the combination of ingredients found in commercial products.[13] "Inert" ingredients used in triclopyr herbicides include the amine salt of dodecylbenzenesulfonic acid[14], ethanol,[2] ethylenediamine tetraacetic acid,[2] a petroleum solvent[14] containing kerosene,[3,5-7] polyglycol,[15] ethoxylated sorbitan monooleate,[14] and triethylamine.[2] See "Hazards of Inerts in Triclopyr Products," right, for more information.

Acute Toxicity

Symptoms of short-term exposure to triclopyr include lethargy incoordination, weakness, difficult breathing, and tremors. Anorexia and diarrhea have also been observed in animals exposed to triclopyr.[16]

EPA classifies the triethylamine salt of triclopyr in the agency's highest acute toxicity category for eye irritation. It is "corrosive" to eyes with damage lasting over three weeks. Both the amine salt and the butoxyethyl ester sensitize skin,[17] so that subsequent exposures cause greater allergic reactions than the first exposure.[18]

Subchronic Toxicity

In a subchronic (medium-term, 3 month) laboratory feeding study with rats, triclopyr caused kidney damage (degeneration of tubules). This damage was observed at doses of 20 milligrams per kilogram (mg/kg) of body weight per day.[19]

There are no publicly available subchronic toxicity studies of commercial triclopyr-containing products.

Chronic Toxicity

In a chronic (long-term) laboratory feeding study, rats fed triclopyr developed kidney damage more often than unexposed rats. In a long-term study using dogs, the animals which were fed triclopyr gained less weight, had less hemoglobin (oxygen-carrying molecules) and red blood cells in their blood, and had more microscopic liver damage than did unexposed dogs. These symptoms were observed at doses of 25 mg/kg per day in the rat study and 20 mg/kg per day in the dog study.[20]

A dog study which showed kidney effects at a tenfold lower dose (2.5 mg/kg per day) was originally used by EPA to calculate acceptable exposure to triclopyr.[21] However, this calculation was criticized by triclopyr's manufacturer because of studies the company conducted showing that triclopyr is more slowly excreted by dogs than other animals, and that the dog kidney is more susceptible than the kidney of other animals.[22,23] As a result, EPA classified the kidney damage as "not a toxic response to the test chemical, but a physiologic response of

HAZARDS OF INERTS IN TRICLOPYR PRODUCTS

Health hazards of inerts used in triclopyr herbicides include the following:

Ethoxylated sorbitan monooleate has caused a drop in blood pressure in dogs given the compound for research purposes. It also has caused adrenal gland tumors in laboratory tests of male rats.[1]

Ethylenediamine tetraacetic acid causes eye and skin irritation and is also irritating to the upper respiratory tract.[2] In laboratory tests with rats, it caused a variety of birth defects: cleft palate, eye defects, and abnormal skeletons.[3]

Kerosene causes severe eye irritation and is also irritating to the upper respiratory tract. Inhalation of kerosene causes fatigue, headache, dizziness, and incoordination.[4] Other symptoms include euphoria, a burning sensation, disorientation, and drowsiness.[5]

Petroleum solvent (with Chemical Abstracts Service registry number 64742-48-9) is damaging to kidneys and to the nervous system. These effects have been demonstrated in both exposed workers and laboratory tests. Some neurological effects are long-lasting or irreversible.[6]

Triethylamine is damaging to eyes and can cause abnormal vision[7] and irreversible damage.[8] It is extremely destructive to skin and the upper respiratory tract. Symptoms of exposure include coughing, wheezing, headache, and nausea.[8]

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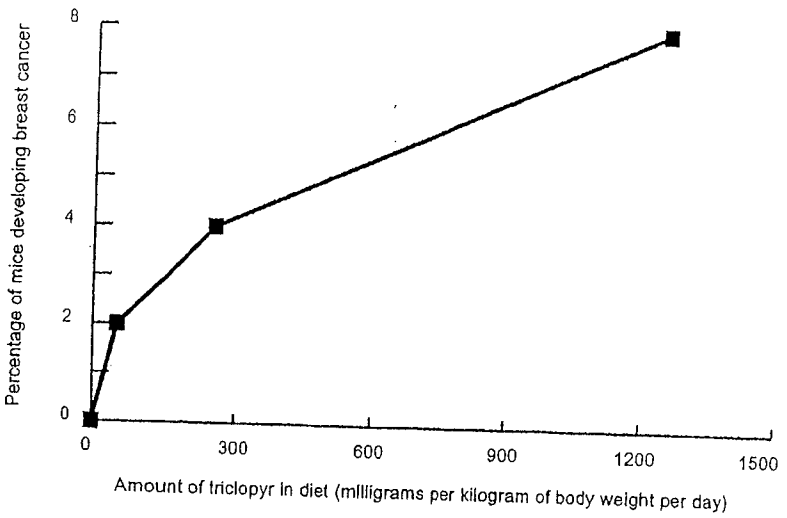
Figure 2
Triclopyr and Breast Cancer



Source: U.S. EPA. Office of Prevention, Pesticides, and Toxic Substances. 1996. Carcinogenicity peer review of triclopyr. Memo from McMahon, T.F., and E. Rinde, Health Effects Div., to R. Taylor, Registration Div. and T. Luminello, Special Review and Reregistration Div. Washington, D.C., May 9.

In laboratory studies with both mice and rats, triclopyr caused a significant increase in the incidence of breast cancer. However, EPA's evaluation of these studies concluded that it was not possible to classify triclopyr's ability to cause cancer.

the dog"[24] and did not use the results in its more recent evaluation of triclopyr.[24]

There are no publicly available chronic toxicity studies of commercial triclopyr-containing products.

Mutagenicity

Triclopyr's mutagenicity (ability to cause genetic damage) has been studied in a variety of laboratory tests. One study looked at triclopyr's ability to cause dominant lethal mutations in rat embryos. Dominant lethal mutations are mutations in sperm that cause the death of the embryo fertilized by the defective sperm, and are studied by counting the number of dead embryos in pregnant animals. In a study of female rats mated with males who had been dosed with triclopyr, the frequency of embryo loss increased at the middle and high dose (7 and 70 mg/kg).[25]

In seven studies of other kinds of genetic damage that were submitted by triclopyr's manufacturer in support of its registration as a pesticide, no mutagenicity was observed.[25]

There are no publicly available mutagenicity studies of commercial triclopyr-containing products.

Carcinogenicity

Triclopyr's carcinogenicity (ability to cause cancer) has been studied in rats and mice. In both species, feeding of triclopyr significantly increased the frequency of breast cancer (mammary adenocarcinomas).[26] (See Figure 2.)

In EPA's evaluation of these studies, the agency called this carcinogenic response "marginal."[26] EPA therefore classified triclopyr as a Group D carcinogen, one that is "not classifiable as to human carcinogenicity,"[26] even though EPA's guidelines call for classifying pesticides as carcinogens if they cause cancer in laboratory tests of more than one species.[27]

In male rats, triclopyr caused an increase in the frequency of adrenal tumors.[26]

There are no publicly available carcinogenicity studies of commercial triclopyr-containing products.

Effects on Reproduction

Triclopyr, its triethylamine salt, and its butoxyethyl ester have all caused reproductive problems in laboratory tests. Rats fed triclopyr for two generations had smaller litters and smaller offspring than did unexposed rats. Pregnant rats fed the amine salt had offspring that weighed less and had more skeletal abnormalities than offspring from unexposed rats. Pregnant rabbits fed the amine salt had fewer litters, fewer live fetuses, and more embryo loss than did unexposed rabbits. Pregnant rabbits fed the ester had fewer live fetuses, more embryo loss, and offspring with more skeletal abnormalities than did unexposed rabbits. These reproductive problems occurred at doses of 100 and 250 mg/kg per day.[28]

Recently, pesticide regulators, researchers, and the general public have become increasingly concerned about more subtle effects on reproduction. Of special concern has been the possibility that pesticides might interfere with the development of the nervous system. A new (1999) study shows that the major breakdown product of triclopyr causes this kind of effect. See "Hazards of Triclopyr's Major Metabolite," p. 18 for details.

There are no publicly available studies of how commercial triclopyr-containing products affect reproduction.

Effects on Birds

Triclopyr decreases the survival of newly hatched nestlings. In tests with mallard ducks, ducklings hatched from eggs laid by mother ducks that were fed triclopyr had a survival rate that was between 15 and 20 percent lower than the survival rate of ducklings from unexposed mothers. Effects occurred at concentrations in the ducks' food of 200 parts per million (ppm).[29,30]

Effects on Fish

According to EPA, the butoxyethyl

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ester form of triclopyr is the form that is most toxic to fish. The ester is "highly toxic" to four of the five species tested: rainbow trout, bluegill sunfish, coho salmon, and the tidewater silverside. The most sensitive life stage and species in laboratory tests is the yolk-sac fry of the coho salmon, with a median lethal concentration (LC_{50}: the concentration that kills half of a population of test animals) of less than 0.5 ppm.[31]

Triclopyr's butoxyethyl ester also affects fish behavior. In laboratory tests with rainbow trout, concentrations of 0.6 ppm resulted in rapid respiration, flared gills, and erratic, disoriented swimming.[32]

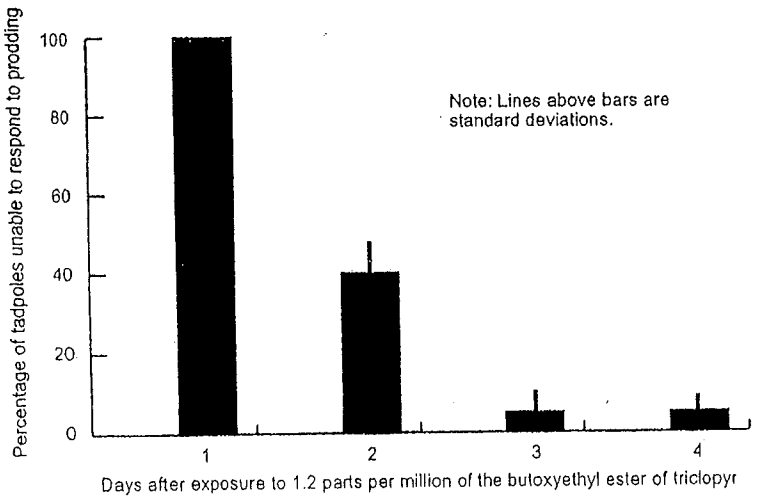
A field study in Ontario, Canada, found similar effects of the butoxyethyl ester on fish. In lake enclosures about half of the tested rainbow trout died at concentrations of 0.45 ppm and mortality reached 100 percent at concentrations of 0.69 ppm. Reduced growth occurred at even lower concentrations, 0.25 ppm. The Canadian researchers also found reduced growth in young rainbow trout following application of the ester to a forest stream.[33]

The concentration of the triethylamine salt required to kill fish is much greater than that of the butoxyethyl ester.[34] However, effects on behavior ("voluntary neuromuscular control was lost and all the fish lay flaccid on the bottom, with irregular and labored breathing,"[32] according to the description written by the researchers who conducted this study) have been observed at lower concentrations, one-half the LC_{50}.[32]

Effects on Frogs

A study of three species of frogs in Ontario, Canada, found that low concentrations of triclopyr butoxyethyl ester inhibited their avoidance behavior. Tadpoles normally move when touched or prodded; this behavior helps them escape predation. Tadpoles of all three species exposed to just over 1 ppm of triclopyr lost their avoidance response, and either "twitched in place or were completely unresponsive" when prodded. (See Figure 3.) The researchers, from Trent University and the Canadian Wildlife Service, concluded that exposure to 1.2 ppm of triclopyr "is likely to paralyze the more sensitive tadpoles, and such exposure may occur in a managed forest system."[35]

Figure 3
Triclopyr and Tadpole Behavior



Source: Berrill, M. et al. 1994. Effects of low concentrations of forest-use pesticides on frog embryos and tadpoles. *Environ. Toxicol. Chem.* 13:657-664.

Normally, tadpoles dart away when prodded. This behavior helps them escape from predators. Green frog tadpoles exposed to the ester form of triclopyr ate unable to respond normally; they either twitch in place or remain still.

Effects on Beneficial Insects and Spiders

Triclopyr can impact populations of beneficial insects and spiders, those that provide an economic benefit to agriculture, by killing plants on which the insects and spiders depend for food and shelter. For example, in a study of carabid (ground) beetles and spiders in a hawthorn hedgerow around an agricultural field in the United Kingdom, spraying with a triclopyr-containing herbicide caused decreases in populations of both predators.[36] In addition, the triclopyr herbicide Grazon was toxic to a spider mite used as a biological control agent to reduce populations of gorse. Typical application rates caused over 60 percent mortality. The authors concluded that "even low rates of these chemicals are likely to prevent mite establishment."[37]

Effects on Oysters

Oyster larvae are more susceptible to triclopyr than other estuarine or marine animals. In a test with embryos and larvae of the Eastern oyster, all individuals developed abnormally at a concentration of 87 ppm.[38]

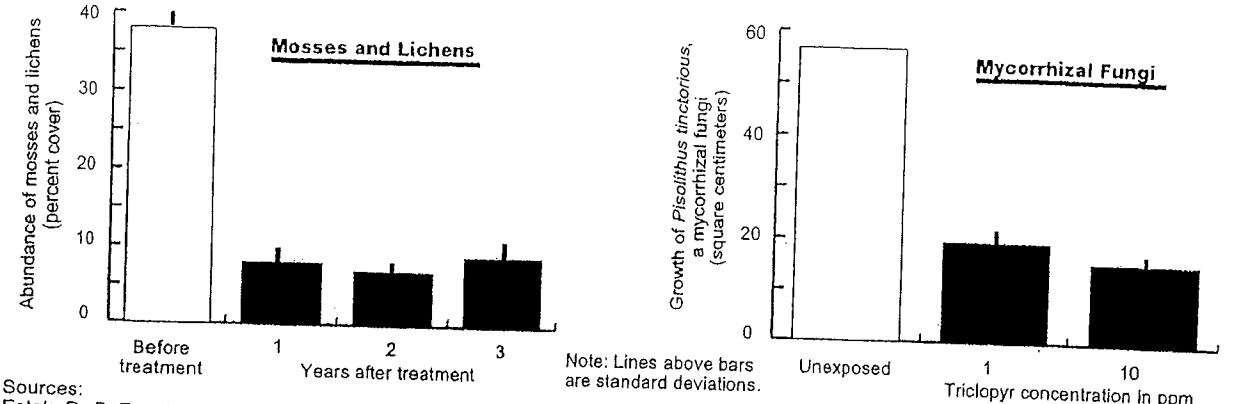
Effects on Small Mammals

Treatment of a Canadian spruce plantation with the triclopyr herbicide Release decreased populations of the red-backed vole, the second most abundant small mammal. Triclopyr treatment decreased vole populations; they were reduced by about 80 percent from those in untreated areas one year after treatment. In the second year after treatment, vole populations were still reduced over 50 percent compared with untreated areas.[39]

Complex Ecological Interactions

While complicated ecological effects of a pesticide are rarely studied, studies of

Figure 4
Examples of Triclopyr's Effects on Nontarget Plants



Sources:
Estok, D., B. Freedman, and D. Boyle. 1989. Effects of the herbicides 2,4-D, glyphosate, hexazinone, and triclopyr on the growth of three species of ectomycorrhizal fungi. *Bull. Environ. Contam. Toxicol.* 42: 835-839.
Newmaster, S.G., F.W. Bell, and D.H. Vitt. 1999. The effects of glyphosate and triclopyr on common bryophytes and lichens in northwestern Ontario. *Can. J. For. Res.* 29:1101-1111.

Triclopyr has a variety of effects on plants which are not intended to be targets of its herbicidal activity. Triclopyr treatment reduces the abundance of mosses and lichens in forest ecosystems. It also reduces the growth of beneficial mycorrhizal fungi.

triclopyr have found unexpected impacts on several levels of an ecosystem.

Two studies by researchers from Oklahoma State University looked at the link between triclopyr treatment and the abundance of parasitic worms in cotton rats and cottontail rabbits in an area of oak forest and tallgrass prairie. In both studies, certain species of parasites were less common in animals trapped in areas that had been treated with triclopyr. These parasites use insects and mites as hosts during part of their life cycle. Triclopyr, by reducing vegetation and therefore increasing temperatures on the forest floor, reduced populations of these insects leading to reduced populations of the parasites. A study of intestinal roundworms in mice conducted in the same forests had similar results.[40-42]

Use of triclopyr to kill unwanted vegetation on loblolly pine plantations also resulted in complex ecological interactions. Triclopyr-treated trees were approximately twice as likely as untreated trees to be damaged by the tip moth. The tip moth damage then increased the risk for fusiform rust, a pine disease.[43]

A third example of complex ecological interactions involves populations of slugs and snails in spruce forests. The slugs and snails are used as "indicators of ecosystem change" because they are important components of boreal ecosystems and vulnerable to pesticide effects because they are relatively immobile. A Canadian study found that areas treated with the triclopyr herbicide Release had approximately half as many slugs and snails as did untreated areas. The reduction in numbers of slugs and snails was attributed to lack of vegetation: because plants were killed by the triclopyr, the soil surface was warmer and drier and there was less leaf litter deposited on the soil.[44]

Effects on Nontarget Plants

As a broadleaf herbicide, triclopyr efficiently kills many species of plants. However, it can also have unintended effects on plants that are not the target of the herbicide application. These effects include drift damage, genetic damage, inhibition of mycorrhizal fungi, reduction of nitrogen cycling, damage to mosses and lichens, and stimulation of algae blooms.

Drift damage: Because it is a potent herbicide, tiny amounts of triclopyr can damage sensitive plants. For example, nine species of ornamental annual flowers were damaged by triclopyr in amounts equivalent to 0.05 percent of the maximum application rate recommended on product labels[45]; less than 0.1 percent of the maximum label rate damaged peanut and cucumber seedlings[46]; and less than 1 percent of the maximum rate is sufficient to reduce yield of cotton plants.[47] When EPA assessed risks from drift of triclopyr,[48] they concluded that one low-rate use, ground applications on rice, did not exceed the agency's "level of concern," but "in all other registered uses for both triclopyr triethylamine and triclopyr butoxyethyl ester, the level of concern for acute risk to nontarget plants"[48] was exceeded.

Genetic damage: In dividing onion root cells, triclopyr butoxyethyl ester causes the formation of abnormal chromosomes.[49]

Mycorrhizal fungi: Triclopyr herbicides inhibit the growth of a number of species of mycorrhizal fungi. (See Figure 4.) These are fungi that grow in or near plant roots and increase the uptake of nutrients by the plant. The most sensitive species are inhibited by concentrations of 0.1 ppm.[50,51] Using the GLEAMS

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(Groundwater Loading Effects of Agricultural Management Systems) model developed by the U.S. Department of Agriculture,[52] the U.S. Drug Enforcement Agency calculated that soil concentrations of the triethylamine form of triclopyr used at typical application rates would equal or exceed the concentrations that have inhibited the growth of mycorrhizal fungi.[53]

Nitrogen cycling: Atmospheric nitrogen must be transformed by microorganisms before it is usable by plants as a nutrient. One step in this process, transformation of ammonia to nitrite, is inhibited by triclopyr. A laboratory study at the Swedish University of Agricultural Sciences found that triclopyr was more potent in reducing this activity than about 70 percent of the 48 pesticides tested.[54]

Mosses and lichens: Mosses and lichens are important parts of forest ecosystems, contributing to nutrient cycling, production of high-quality seedbeds, and maintenance of appropriate moisture content. Application of the butoxyethyl ester of triclopyr reduced the diversity of mosses and lichens on a replanted clearcut in Ontario, Canada, by 60 percent. The abundance of mosses and lichens at the same site was reduced 75 percent. (See Figure 4.) The reductions persisted for the duration of the study, two years.[55] In a laboratory study, triclopyr damaged membranes and decreased photosynthesis in the lichen *Peltigera*.[56]

Algae: Treatment of a Canadian stream with concentrations of the ester form of triclopyr designed to mimic an accidental overspray caused an increase in the growth of algae in the stream. This algae bloom persisted for 40 days. Researchers believe that the algae growth was either the result of excessive nutrients, if the algae used the triclopyr as a source of nutrients, or a result of triclopyr's activity as a plant hormone.[57]

Endangered Species

According to EPA's assessment of triclopyr's risks to endangered species, the agency's "levels of concern"[58] are exceeded for the triethylamine salt of triclopyr for birds, mammals, and aquatic and terrestrial plants. For the butoxyethyl ester, "levels of concern"[58] are exceeded for birds, mammals, fish, aquatic invertebrates, estuary species, and aquatic and terrestrial plants. EPA has not yet determined what protective measures are necessary.[58]

Persistence in Soil

Triclopyr's persistence in soil is variable. According to EPA, half-lives (the amount of time it takes for half of an applied chemical to break down or move away from the treatment site) of triclopyr measured in field studies varied from 10 to almost 100 days. In general, half-lives were longer on forestry sites than they were on agricultural sites.[59]

EPA also reported that enough triclopyr persisted in field studies to reduce the yield of cucumber plants for 3 or 4 months after treatment with the triethylamine salt, depending on application rate.[60] A field study in western Oregon found that triclopyr persisted for a year after treatment with the amine salt.[61] EPA also reports persistence of over a year in another field study.[62]

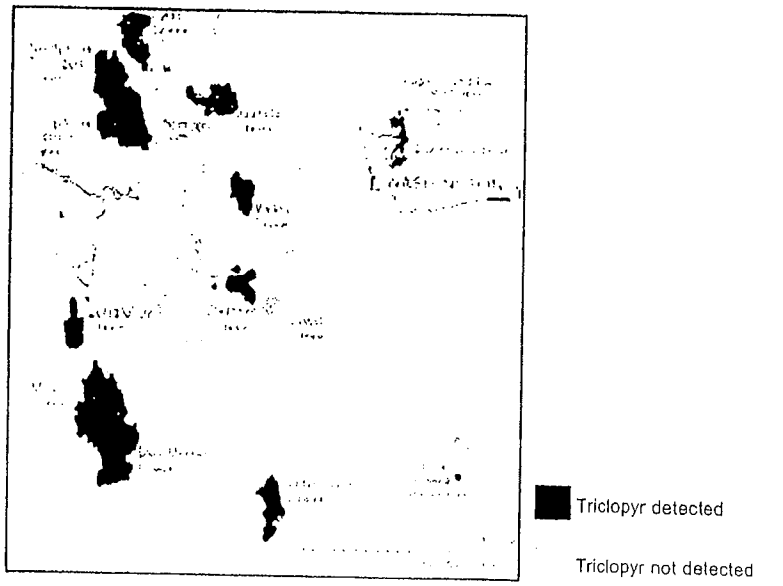
Mobility in Soil

According to EPA, triclopyr is "very mobile" in soil.[63] Triclopyr molecules are not strongly held by soil or sediment particles.[64]

Contamination of Water

Ground water: Since triclopyr is mobile in soil, as well as "somewhat persistent," EPA "believes this chemical has the potential to leach to ground water."[65] Although there has been "limited monitoring for triclopyr in ground water,"[65] studies have found triclopyr contamination

Figure 5. Triclopyr in Urban Streams



Sources:
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Triclopyr was found in all but two of the urban streams studied by the USGS near Seattle, Washington.

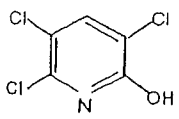
in wells in two states, Virginia and Texas.[65] The GLEAMS model indicates that the triethylamine salt of triclopyr amine is more likely to move through soil and into ground water than the butoxyethyl ester.[66]

Surface Water: Triclopyr also contaminates rivers and streams. A recent national monitoring program conducted by the U.S. Geological Survey (USGS) found triclopyr in 8 of the 20 river basins studied.[67]

On a smaller scale, a USGS study of 10 urban watersheds near Seattle, Washington, found triclopyr at 90 percent of the sites sampled,[68] indicating that contamination of urban streams with triclopyr may be widespread. (See Figure 5.) Triclopyr has also contaminated streams following aerial forestry applications; rivers following applications to rice fields; and surface water following golf course applications.[61,69-72]

The GLEAMS model indicates that the butoxyethyl ester of triclopyr is more likely to run off into surface water than its triethylamine salt.[73]

Figure 6
3,5,6-Trichloro-2-pyridinol (TCP)



Triclopyr's major metabolite.

Hazards of Triclopyr's Major Metabolite

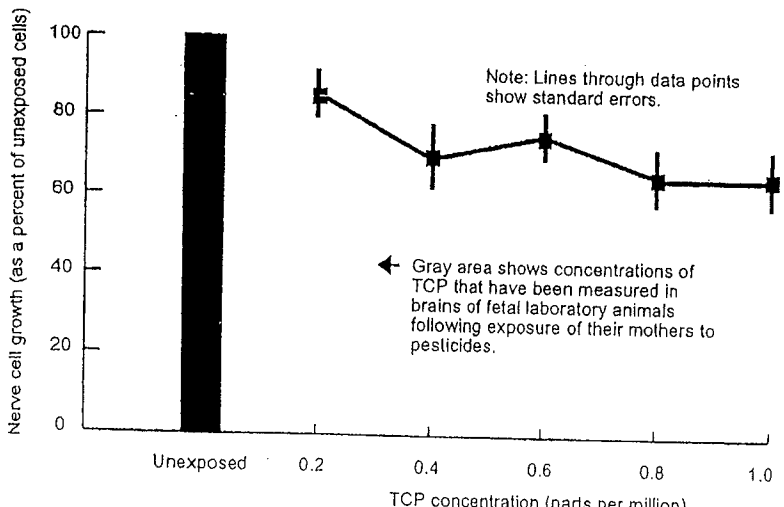
The most common breakdown product of triclopyr in mammals, as well as in soil and water, is 3,5,6-trichloro-2-pyridinol.[74] (TCP; See Figure 6.) TCP has also been found in meat and meat fat.[75] Interestingly, TCP is a major metabolite of the organophosphate insecticide chlorpyrifos.[76]

The most significant health hazard identified for TCP is that it may be especially hazardous to children. Recently (1999), EPA researchers studied the ability of TCP to disrupt the development and maturation of the nervous system that occurs in fetuses, infants, and children. Using a laboratory test system (a cell culture), the researchers showed that exposure to TCP inhibits neurons (nervous system cells) from undergoing normal growth. Concentrations of only 0.2 ppm were sufficient to disrupt growth.[77] (See Figure 7.) Concentrations equal to this level have been measured in the brains of fetal laboratory animals whose mothers were exposed to pesticides. In addition, when researchers compared TCP concentrations in brains of fetal laboratory animals with those in their mothers' brains, the fetal concentrations were between two and four times greater than those in maternal brains, suggesting that TCP accumulates in fetal brains.[78]

TCP also disrupts the functions of mitochondria, structures in virtually all cells that convert food into energy usable by the cell. In a study using mitochondria from rat liver cells, concentrations of 2 ppm TCP reduced four measures of mitochondrial function by at least 30 percent.[79]

TCP also poses a variety of environmental hazards: it is "very mobile" in a variety of soil types and is also often more persistent than triclopyr itself[59]; it is toxic to soil bacteria (based on tests of a model species)[80]; and it is toxic to chicken embryos.[81]

Figure 7
Effect of TCP on the Growth of Nerve Cells



Source:
Das, K.P. and S. Barone. 1999. Neuronal differentiation in PC12 cells is inhibited by chlorpyrifos and its metabolites: Is acetylcholinesterase inhibition the site of action? *Toxicol. Appl. Pharmacol.* 160:217-230.
Hunter, D.L., T.L. Lassiter, and S. Padilla. 1999. Gestational exposure to chlorpyrifos: Comparative distribution of trichloropyridinol in the fetus and the dam. *Toxicol. Appl. Pharmacol.* 158:16-23.

In laboratory studies relatively low concentrations of TCP inhibit the growth of nerve cells.

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● HERBICIDE FACTSHEET

IMAZAPYR

Imazapyr is a broad-spectrum herbicide in the imidazolinone family. Its primary uses in the U.S. are for vegetation control in forests and rights-of-way.

Imazapyr is corrosive to eyes and can cause irreversible damage. Imazapyr-containing herbicides are irritating to both eyes and skin.

Adverse effects found in laboratory animals after chronic exposure to imazapyr include the following: fluid accumulation in the lungs of female mice, kidney cysts in male mice, abnormal blood formation in the spleen of female rats, an increase in the number of brain and thyroid cancers in male rats, and an increase in the number of tumors and cancers of the adrenal gland in female rats.

Imazapyr can persist in soil for over a year. Persistence studies suggest that imazapyr residues damage plants at concentrations that are not detectable by laboratory analysis.

Imazapyr moves readily in soil. It has contaminated surface and ground water following aerial and ground forestry applications.

Small amounts of imazapyr (as little as 1/50 of a typical application rate) can damage crop plants. Imazapyr exposure also has the potential to seriously impact rare plant species. The U.S. Fish and Wildlife Service has identified 100 counties in 24 states east of the Mississippi River where endangered species may be jeopardized by use of imazapyr.

Over a half-dozen weedy plant species have developed resistance to imazapyr.

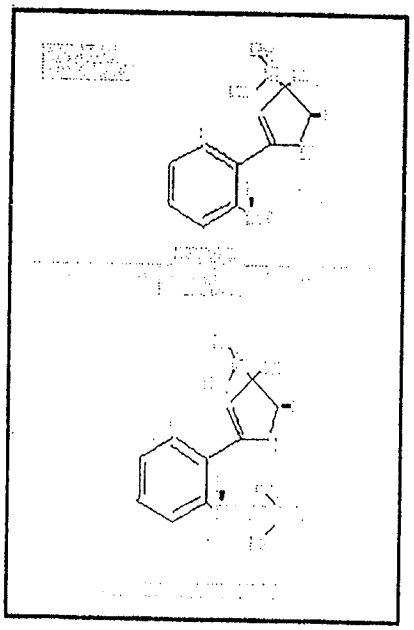
By Caroline Cox

Imazapyr (see Figure 1) is a broad-spectrum imidazolinone herbicide used to kill unwanted plants in industrial sites, coniferous forests, railroad rights-of-way, rubber plantations, oil palm plantations, and sugarcane.[1] Commercial products use the isopropylamine salt of imazapyr.[2]

Imazapyr is manufactured by American Cyanamid Co. and sold under the trade names Arsenal, Chopper, and Assault. It was first registered in the United States in 1984.[1]

Mode of Action

Like all members of the imidazolinone family of herbicides, imazapyr kills plants by inhibiting the first enzyme used when plants synthesize branched chain amino acids (valine, leucine, and isoleucine). The name of this enzyme is acetohydroxyacid synthase.[1] (This enzyme is also known as acetolactase synthase.) Amino acids are the building blocks from which living organisms make proteins. The enzymes needed to synthesize the branched chain amino acids are not present in animals, who must obtain these amino acids by eating them.[3] Another class of herbicides, the sulfonylureas, has a similar mode of action.



Within a few hours after treatment with imazapyr, synthesis of DNA (genetic material)[4] and cell division stops. Next plant growth stops, first in the roots and then in growing portions of the above ground plant. This is presumably because of the lack of necessary amino acids.[1] Complete death of the plant occurs slowly, taking as long as a month after treatment.[1]

Acute Toxicity

The amount of imazapyr required to kill mammals by oral ingestion, exposure through the skin, or inhalation is relatively large. In most of the laboratory studies submitted to the U.S. Environmental Protection Agency (EPA) in support of imazapyr's registration, few or no deaths occurred even

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