

NCEPPC 2013

# **Environmental Impacts of Non- Herbicidal Weed Control**

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Dow AgroSciences Retired

# Herbicidal Methods

- Environmental impacts studied scientifically for 50 years showing positive impacts from herbicide use
- Herbicides are industry standards
- Excellent data and PR efforts have been put together demonstrating the benefits of using herbicides
- Presumed negative impacts of herbicides covered in popular press, internet pages, blogs, and other channels
- The vegetation management community continues to have “Non-Chemical” alternatives pushed on us

# Facts

- You can't agree or disagree with a fact.
- If a fact leads you away from your own preconceived beliefs, you go there anyway.

# Non-Chemical Methods

- “Non-Chemical” or “without harmful chemicals” are the terms used by proponents of these methods
- Crosses over into “organic” methods
- Suggested to be used by:
- Neighbors
- Anti- Activists
- Concerned Management
- Natural or Green Proponents
- Those who do not think through the whole process



# Practice Integrated Pest Management (IPM)

- Prevention
- Cultural: cover crops, mulches, smother, livestock grazing
- Mechanical: scuffle hoe, cutting (mowing, weed eater), pulling, burning, tilling, digging
- Chemical: organic, commercial preparations
- Planting/restoration after control

Don't Make Chemical Control  
Your First Choice



Great Smoky Mountains National Park Resource Management  
Archives, USDI National Park Service, [www.insectimages.org](http://www.insectimages.org)

# Marin County, Non-Chemical Invasive Control

- Propane Torch Flaming
- Hot Foam - uncommon, expensive tool, road access needed
- HydroMechanical Obliteration - uncommon, expensive tool, road access needed
- Scraping/Pulling - Heavy Equipment
- Cutting/Mowing - brushcutter (powered) - repeated, consistent cutting can reduce flowering
- Cutting/Mowing - Heavy Equipment - repeated, consistent cutting can reduce flowering

# WA Toxics Coalition

- Non-Chemical Aquatic weed control
- Bottom Barriers – heavy, durable blankets designed to compress vegetation and block sunlight, made of plastic, mylar, woven synthetics. \$750 per 1000 sq feet (\$32,600 per acre)
- Harvesting – giant lawnmower, cut 5 – 10 feet deep, remove material, have to be used more than once in a season. (How many native species of flora and fauna are removed with the weeds?)

# MA Aquatic Weed Control

- Natick, MA harvest milfoil in ponds, citizens group against toxic chemicals. Use the non-chemical boat harvester
- Costs of \$8,000 – 24,000 per acre. Repeat at least yearly.
- Divers pulled weeds around beaches for \$25,000, weeds returned in a few weeks
- Adjoining town used Renovate herbicide, milfoil is dead. \$400 per acre



# If You Use Herbicides, Remember Safety First

- Read the label carefully, follow the instructions, understand precautionary statements
- Get a copy of the Material Safety Data Sheets (MSDS)
- Wear proper personal protective equipment (ppe)



# Impacts Of Not Using Herbicides

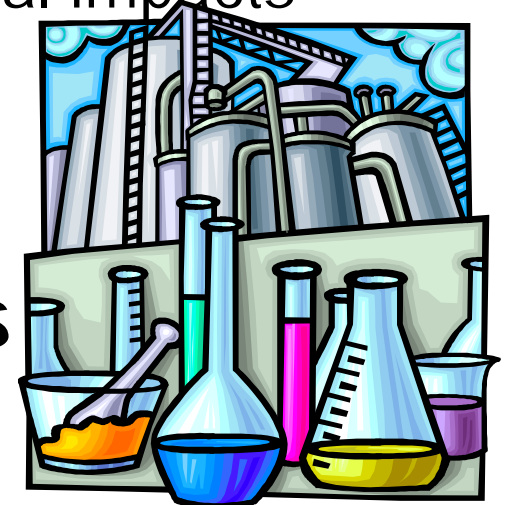
- Herbicides can have negative impacts
- Not ignoring these impacts, but want to discuss the negative environmental consequences that result from a decision not to use herbicides.
- These impacts totally ignored by many land managers and the general public.
- EIS documents dismiss these impacts without discussion



# Non-Chemical Methods vs Herbicides

My research shows “non-chemical” methods:

- Use a larger volume of chemicals
- Use more dangerous chemicals
- Expose people to more dangerous chemicals
- Have potentially greater environmental impacts
- Have lower worker safety records
- **Non-Herbicidal chemicals are not benign and have their own impacts**



# Environmental Efficiency

- “Alternatives” are proposed without examining the total environmental impact
- Many Alternatives use more labor, energy and fuel.
- If the Alternative costs more, it takes more of our tax dollars or GNP to pay for the vegetation management.
- People have to go to work and live their daily lives to pay these extra dollars, and the environment is impacted by these activities.



# Popular Non-Chemical Methods

- Natural Herbicides, Organic Herbicides
- Plastic mulch and barriers
- Weed burners, torches, steamers
- Grazing
- Mechanical methods: tractors, mowing, plowing, chain saw use
- Manual methods
- Organic Notes

# Natural Herbicides

- State of New York and MA researched these, they have been proposed for use from Seattle to Maine to Arkansas to Canada.
- Common products suggested include EcoExempt HC, Burn Out II, Scythe
- Mimic natural plant based chemicals
- Little or no ecotoxicity or worker exposure data is available, they are on the exempt list established by EPA
- MSDS for these products are thin and not very informative

# Natural Herbicides

- EcoExempt HC – Clove oil and phenyl propionate
- Data just on the clove oil portion of this product, most of it collected by anti-herbicide project for Marin County, CA:
- Possible carcinogen
- Highly toxic to fish
- Severe eye, respiratory, and skin irritant.
- Used at 10 to 30 gallons of product to the acre. Burn down only, no long term control. Greenhouse gas.
- The active ingredients may not be obtained from plants

# Clove Oil

- MA suggested clove oil use near water to protect from herbicides
- Clove oil is not registered for use in water, except for stunning or killing fish
- Garlon 3A, Accord Concentrate, DMA 4, Habitat, others, are registered for use in water and have data to support their use
- Assuming natural products are not toxic is a bad assumption



# EcoClear™

## Fast Acting Weed and Grass Killer

For non-selective control of herbaceous broadleaf and grass weeds in non-crop, right-of-way and industrial land sites.

Eyes, burns and permanent corneal injury  
Skin irritation or allergic reaction  
Digestive tract reactions or damage  
Respiratory tract irritation

**COMMERCIAL**

**GUARANTEE:** acetic acid...25 % W/W (250 g/L)

**READ THE LABEL BEFORE USING**  
**KEEP OUT OF REACH OF CHILDREN**

**REGISTRATION NO. 25528**  
**PEST CONTROL PRODUCTS ACT**



**CAUTION:**  
**SKIN IRRITANT**

**DANGER:**  
**CORROSIVE TO EYES**  
**NET CONTENTS: 10 L**



**ECOVAL**

Manufactured for:  
Ecoval Inc.

280, Church St., Oakville, ON  
L4J 1N9 Canada Tel.: 1-866-298-2228  
<http://www.naturesglory.com>

\*Trademark of Ecoval Inc.

# Natural Herbicides

- Scythe is an organic herbicide made of pelargonic acid, which naturally occurs in many plants.
- Raw materials include anhydrous butyl alcohol, sodium, ethyl malonate, heptyl bromide, potassium hydroxide, and hydrochloric acid
- You can't just squeeze the plants and have it drain out!
- Rainforest botanicals, anyone?

# Natural Herbicides

- U. Mass Transportation Center Study:
- Natural Herbicides, Citric Acid, Acetic Acid, Clove Oil, Scythe<sup>®</sup>, etc = **\$360 to \$2400 per mile**
- Glyphosate = **\$20 per mile**
- **Commerce/Work Needed to Pay Taxes**
- **This is an ENVIRONMENTAL IMPACT**

# Natural Herbicides



- "Natural Herbicide"
- Hours per year per mile = 24
- Glyphosate
- Hours per year per mile = 8
- These extra hours are an environmental impact

# Corn gluten meal



**220 lb CGM/1,000 sq ft on burned plot**

# Natural Herbicides

- Clove and Citrus oil mix VS Accord
- Volume per acre, weed control
- |              | Citrus Oil         | Glyphosate       |
|--------------|--------------------|------------------|
| ● LOW Rate   | <b>1280 ounces</b> | <b>16 ounces</b> |
| ● HIGH Rate  | <b>3200 ounces</b> | <b>64 ounces</b> |
| ● Difference | 80 times greater   | 50 times greater |
- What else is impacted by these tremendous volumes???
- These extra volumes are a chemical environmental impact

# Plastic Barriers

- Polyethylene barriers and permeable weed plastic, mats
- Placed on the soil or over vegetation to stop weeds from germinating or kill vegetation
- Often recommended for for invasive species like kudzu. 2 years of use can give 90% control.

Recommended in sub-stations,  
Structures, guardrails,  
Slopes, etc



# Plastic Mulch

Proponents of its use give these negatives:

- Non-selective, controls all vegetation
- Mosquitoes breed in rainwater puddles on sheets
- Expensive, labor intensive
  
- Research shows: can raise soil temperatures by 10<sup>0</sup> C or more, resulting in potentially negative effects on soil flora and fauna



# Plastic Mulch

- 1328 POUNDS of 6 mil polyethylene needed to cover one acre: \$2000/acre
- Oil and natural gas are the raw materials  
**Greenhouse gases** released in manufacture
- More than 200 degradation products: alkanes, alkenes, ketones, aldehydes, alcohols, carboxylic acid, keto-acids, dicarboxylic acids, lactones ... whose impacts have not been studied.



*FACT: 14 ounces of Milestone VM herbicide gives a similar or better level of control of kudzu.*

# Plastic Mulch Paradox

- Plastic mulch is used by organic growers who dislike big chemical companies
- Containers of plastic weed cloth in Wal-Mart feature big letters, “non-chemical weed control”
- Polyethylene and other plastics made by Dow Chemical and other chemical giants
- ***FACT: Polyethylene is clearly a chemical method with environmental impacts that should be considered.***

# Weed Burners and Torches

Weed Dragon advertising text:

- Weed Dragon 100,000 BTU Weed Burner
- Environmentally safe way to eliminate weeds
- No chemicals (???)
- No dangerous threats to our environment
  
- Recommended for brush control, guard rail weeds all over the country, substation weed control in Seattle and others



# Weed Burners and Torches

- Use a flammable chemical, propane, that can also explode
- Burning vegetation produces **greenhouse gases**
- Danger of personal injury and property damage.  
Substations????
- Pounds of propane per acre use higher than herbicide
- Propane contains radioactive compounds including radon, lead, polonium, and bismuth
- Heat damages soil flora and fauna?
- Wildfire? Smoke?



# Propane Properties

- Flammable at 2.2% concentration in air
- Propane = dimethylmethane , and maybe ethane, n-Butane, iso-Butane, propylene, butylene
- By products of production include hydrogen sulfide, CO<sub>2</sub>, bitumes

*FACT: Propane burners are clearly a chemical form of weed control with environmental impacts that should be considered*

# Propane Use for Barberry Control

- Foliar spraying is definitely quicker than torches as we covered 2.7 acres today using 26 oz/acre of glyphosate and 3 hr/acre (rough, rocky terrain). It would have taken 6 hr/acre and 24 lbs/acre of propane to do the same work.
- Jeff Ward, Dept of Forestry and Horticulture, The Connecticut Agricultural Experiment Station

# Steaming Weeds



10 to 15 hours to treat  
One mile of guardrail

Impact traffic flow

Worker Safety

2000 gallons to treat  
one acre

2 minutes to steam 80 sq feet

U. Mass Transportation Center

# Grazing

**Hair Sheep During First Pass 300 per Acre**

**Fuel, manure, compaction, eat desirable  
vegetation, fences needed**





# Resources Used for Goats

**Fuel to Haul 75 Goats 120 miles**

**Solar Fence Charger, posts, wire, installation**

**Daily trips to feed dog watching the goats, dog food**

**Weekly trips of 120 miles to check on goats, 5 weeks**



# Resources for Herbicides

- 28 oz Milestone, 1 oz surfactant, 1 backpack sprayer, water, one trip

# Mechanical Methods

All mechanical methods utilize fuel and lubricating oils, and some use hydraulic fluids

- Mowing
- Bulldozing, other heavy equipment clearing, raking, shearing
- Mulching machines
- Chain saw and other hand-held mechanical saws



# Mechanical Methods

- Greenhouse Gases

# WARNING

## **NO SMOKING STOP MOTOR**

Smoking and running engines can ignite a spark. To reduce the risk of fire, extinguish all smoking materials and turn off engine before fueling process.



**ALWAYS** extinguish cigarettes before getting out of your car.



**NEVER** leave engine running during fueling process.

## **Electrical Discharge Warning**

Cellular phones, pagers and personal electronic devices may cause electrical discharge. **Do not** use while fueling.



**NEVER** use electronic devices during fueling process.



**NEVER** allow children to use pump. Only persons of licensed age should use pump. Keep children away from pump area. **Do not** allow children under licensed age to use the fuel dispenser.

## **HEALTH WARNINGS**

- Gasoline is harmful or fatal if swallowed.
- Long-term exposure to vapors has caused cancer in laboratory animals.
- Avoid prolonged breathing of vapors.
- Keep face away from nozzle and gas tank.
- Keep away from eyes and skin.
- Never siphon by mouth.
- For use as a motor fuel only.

## **Static Electric Spark Explosion Hazard**

A static electric spark can occur when filling portable containers sitting on truck bed liners or on any vehicle's carpeting or floor matting. This spark will explosively ignite a gasoline vapor fire. **SERIOUS INJURY OR DEATH COULD OCCUR.** It is unlawful and dangerous to dispense gasoline into unapproved containers.



**NEVER** fill portable containers that are in or on vehicle.



**ALWAYS** place containers on ground. Keep nozzle in contact with container while filling.



**BEFORE** fueling, discharge any static electricity build-up by touching your bare hand to a metal surface away from the nozzle.



**DO NOT** re-enter your vehicle while gasoline is pumping. Re-entry could cause static electricity build-up.

**DO NOT OVERFILL TANK OR PORTABLE CONTAINER.**

## **Hold-Open Latch Warning**

Persons using dispensers with hold-open latches must remain at the refueling point during fueling process.



**NEVER** leave refueling area when using dispensers with hold-open latches.

## **IN CASE OF FIRE**

- **DO NOT REMOVE NOZZLE FROM VEHICLE.**
- Evacuate all passengers from the vehicle and refueling area.
- Activate Emergency Shutoff Switch.
- Notify attendant.
- Call 911, if no attendant is on site.

# Gasoline Label

**• USE AS MOTOR FUEL ONLY • DO NOT USE AS A SOLVENT OR CLEANING AGENT • EXTREMELY FLAMMABLE — VAPORS MAY EXPLODE**

- No smoking.
- Stop engine.
- Do not overfill tank, or top off tank.
- Keep away from heat, sparks and flame.
- Keep face away from heat, nozzle and gas tank.
- Never siphon by mouth.
- Harmful or fatal if swallowed.
- Keep away from eyes and skin.
- Prolonged high-level exposure may cause serious health problems.
- Long-term exposure to vapors has caused cancer in laboratory animals.
- Avoid prolonged breathing of vapors.
- Keep away from children.
- Failure to use caution may cause injury or illness.

# Mechanical Methods

## Gasoline

- The LD50 around 635
- Mixture of up to 15 chemicals
- Cancer hazard, flammable, and contains chemicals that can damage the body and internal organs
- Gasoline ~ 2-10 times more toxic than popular industrial herbicides
- Spills extremely dangerous to fish and wildlife. Do you have a spill plan for fuel?
- Diesel less toxic than gasoline, but has many of the same drawbacks, exhaust gases

# Mechanical Methods

## Fuel

Swedish Board of Occupational Safety and Health study of mechanical clearing found that:

- Workers are exposed to poisonous gases and fumes from combustion of 14 liters of fuel per hectare
- Operations deposited an average of 7 liters/hectare of minimally tested fuels and lubricants unburned thru the exhaust
- Chain saw bar oils remains in the soil for up to ten years



# Mowing, Utility ROW

- Mowing reduces quality of wildlife habitat compared with herbicidal methods.

*50 years of study, Bramble and Burns in Pa.*

- Mass. study found better wildlife habitat on sprayed lines compared to mowed and better brush control. At one year, no herbicide residues were found in the soil, but bar oil and hydraulic fluid residues were found in the mechanically cleared areas.

*ECI & Tufts University*

# Mechanical Methods, Mowing

- Fuel use
- Rutting
- Soil erosion
- Destruction of animal nesting sites
- Direct death to animals

Turkey eggs on ROW



# Mowing in a Wetland

- Mowing and cutting almost always the first choice here, but are more polluting and damaging



# Aerial Herbicide Application

Federal EIS Statements Refuse to Consider Aerial

Aerial view of a herbicide application rig with multiple nozzles spraying over a forest.

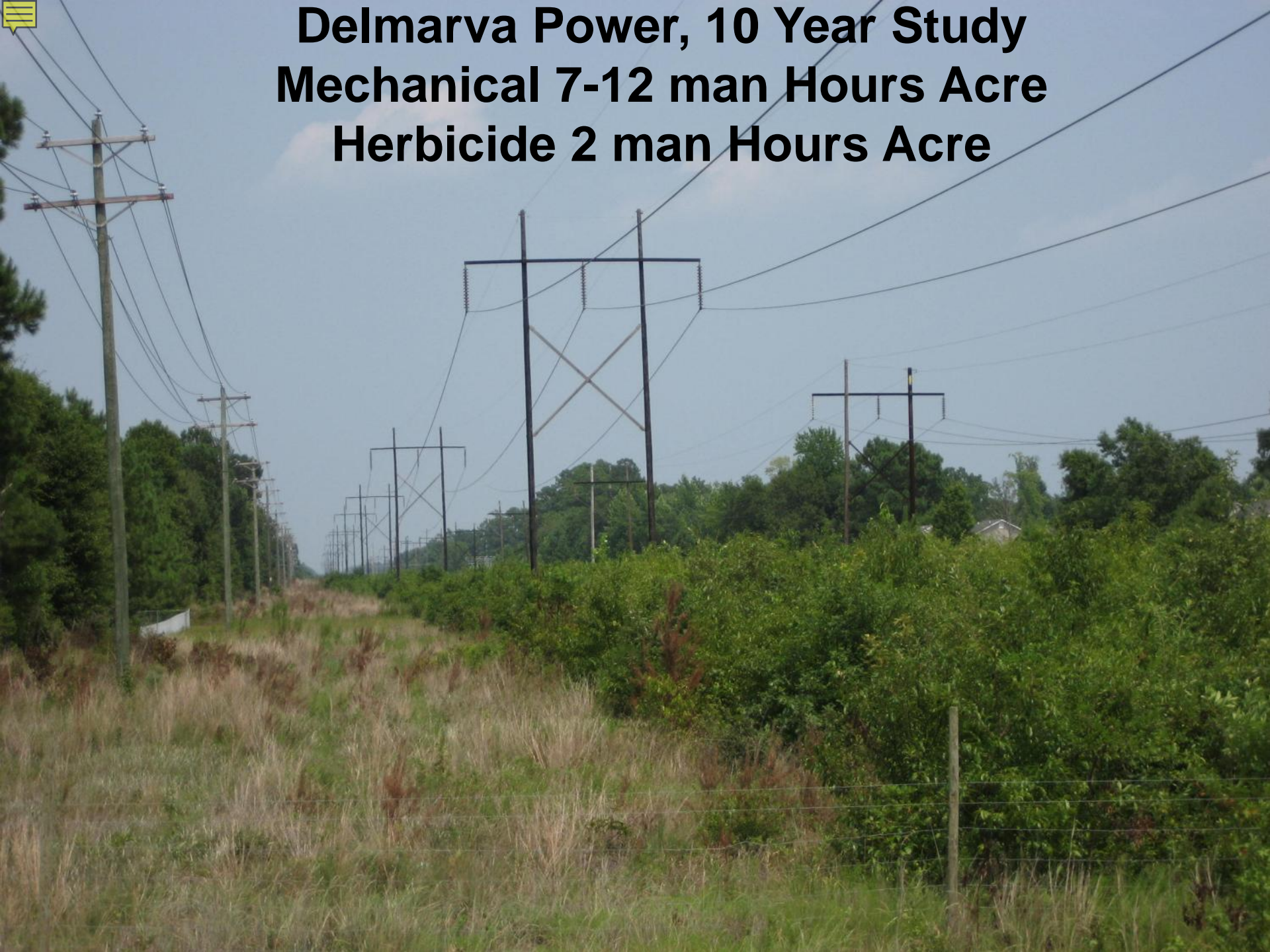
# Mowing In a Front Yard



**More chemical used to cut this than  
spray**



**Delmarva Power, 10 Year Study**  
**Mechanical 7-12 man Hours Acre**  
**Herbicide 2 man Hours Acre**





FLOYD A BOYD

FULL TILL

MADE IN USA

LIFT UNDER SHAFT ONLY

MADE IN USA

Model 1000

Model 1000

Model 1000  
Northwest

MADE IN USA





# Turtle Sushi





**Herbicide Treated ROW**

# Non Chemical Aquatic Control?

Best Practices Being Used



# Mowing or Spraying 30 acres

	Mowing	Herbicide and Growth Regulator
Fuel	30 gallons	1 gal
Herb and Growth Reg		3 pounds
Toxicity of Chemicals Used	Higher	Lower
Greenhouse Gas Emissions	Higher	Lower
Wildlife Habit Value	Lower	Higher

# Mowing on Slopes



# Mowing at Home

- On my lawn, 20 ounces of herbicides per acre reduced my number of mowings versus my neighbors by 5. I don't use a string trimmer, I use herbicides to edge.
- My neighbor used 38.75 pounds/acre more chemical than I did to keep his lawns neat, not counting string trimmers.
- Greenhouse gases, pollution. 8% of the gas going into a mower comes out unburned.



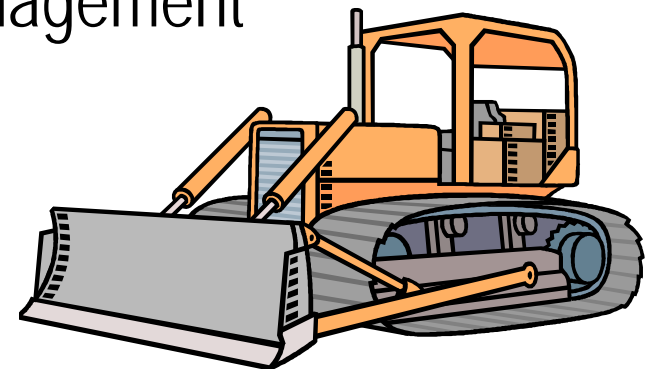


# Home Use

- Herbicides can reduce up to 20% of the 4.8 Billion pounds of fuel used around home for lawn upkeep.
- Wise use of a few million pounds of herbicides could eliminate the use of ~1 Billion pounds of fuel.
- Which method is best for the environment, national security, and safety?

# Mechanical Total Clearing

- Bulldozer, KG blade, shearing and piling
- 5 tons of soil/acre lost on gentle slopes in the SE, soil compaction and habitat loss.
- Fuel use is high
- Habitat loss is high
- Clearing along streams causes severe erosion
- Not generally used for vegetation management







**After Basal application and a flood**

# Mechanical: Before the Flood



After the flood.



# Mulchers



# Backpack Sprayer



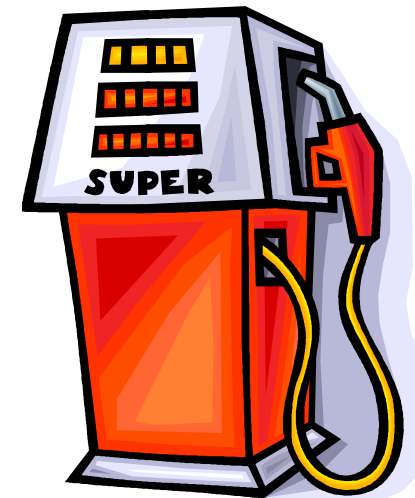


# Hand and Manual Methods

- Hand pulling weeds. Hand saws, machete,
- Weed wrenches
- Hoes, shovels, etc
- Can be quite effective and environmentally sound close to home and on flat ground away from water
- Requires a large amount of time and manpower
- Useful for small areas or where there is a large, local, volunteer labor pool or money is no object

# Hand and Manual Methods

- The mechanized travel needed to get labor to the treatment site uses a very large use of fuel per acre, negating any potential “environmental” benefits
- Pulling of deep rooted species around water or on steep slopes can lead to erosion and site degradation
- Disturbed soil welcomes new invaders
- Seattle City Light, one day of spraying saves 6-8 weeks of labor
- One day of sign and structure spraying = hundreds of hours of hand cutting



# Waterton Knapweed Rodeo



**192 vs 27**

**BY ANNA LEE-CARSWELL**

Ecological Integrity Communications Officer,  
Waterton Lakes National Park

**O**N A FINE SUMMER DAY, 61 volunteers from local communities and partner organizations (and even Park visitors!) joined with 33 Waterton park staff to contribute 445 hours to roping in knapweed for the Annual Waterton Knapweed Rodeo held in July 2009.

will prevent an estimated 850 million seeds from spreading on the Blakiston fan! By pulling knapweed before the flowers go to seed, this invasive plant can be held in check, both now, and in the future, since knapweed seeds can last for up to 8 years before sprouting.

Volunteer prize draws were made at the end of each shift, with fabulous prizes donated by Waterton businesses being awarded. The prizes

Cooley—who won the final draw—won the Parks Canada Pass.

Edwin Knox, in charge of Resource Management and Public Safety for Waterton, says the massive effort helps.

“We didn’t get it all but it sure has been back to some of the areas where we spray Milestone herbicide on

# Worker Injury Comparisons

Comparison	Reportable Injuries	Man Days Lost
Manual : Herbicide	83 : 1	232 : 1
Ground herbicide: Aerial herbicide	7 : 1	8 : 1
Manual : Ground herbicide	24 : 1	60 : 1
Manual : Aerial herbicide	164 : 1	517 : 1

Source, Ontario Ministry of Natural Resources, Craig Howard

# A Challenge to All IPM Options

- “All options should be measured against equally tough standards as are herbicides”
- Direct worker safety
- Exposure to Carcinogens or poisons
- Chronic Effects
- Impacts to the environment
- Pollution, noise
- Cost
- Effectiveness

# Judge All Options by Same Criteria

	Non-target impacts	Worker Safety	Efficacy	Cost
Herbicide				
Manual methods				
Motorized Equipment				
Grazing				

# Weed Control in Organic Cotton vs Reduced Tillage Cropping

- Organic cropping replaces herbicides with tillage
- 0-3 tillages for conventional, 8 to 12 for organic cropping
- Fuel use is dramatically increased in organic cotton production vs no till or reduced till cotton
- 4.8 to 7 gals diesel for organic vs 0 to 1.8 gals bio tech
- Tillage increases erosion and soil compaction. Bare tilled ground loses 12 tons soil/acre/year, 93% veg. residue cover loses 1/3 ton/acre/year.
- No-Till fields have 3 to 6 times as many earthworms

# No-Till Farming and Greenhouse Gas

- No-Till farmland reduces the release of nitrous oxide by 57% when compared to tilling
- No-Till needs herbicides
- Nitrous Oxide can stay in the atmosphere for 120 years
- Nitrous Oxide has 310 times the heat trapping power of carbon dioxide
- Herbicides reduce greenhouse gas warming, organic farming increases it



# Non Chemical Weed Formula for Home

- 4 cups household vinegar or some call for bleach (37% of household poisoning of children)
- 1 cup salt
- Tablespoon of dishwasher detergent " to make it stick to the plants" or "for bonding"
- Isn't dishwasher detergent a mix of chemicals?
- Try planting something after use. Stick your hand in the solution for a while.
- Others include 20% acetic acid, bleach, bleach and salt, add some lemon juice here and there. Chemicals?

# Non-Herbicidal Methods

- Are not benign
- Use toxic chemicals, often at high rates
- Have their own environmental impacts
- These impacts need to be considered by land managers and project planners
- The term non-chemical is inaccurate and needs to be thrown out and new terminology developed
- Education is needed to show risks from everyday chemicals

# Contact Information

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