What is the Future of our Wild Lands?

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The International Agency for Research on Cancer (IARC), an agency of the World Health Organization (WHO), publishes lists of exposures that may or may not cause cancer in humans. The mixed bag of agents and exposures listed in each IARC group raises a basic question: Why is bacon placed in Group 1 (agents and exposures known to cause cancer in humans) with tobacco smoking and aflotoxin, two very dangerous substances? Simply put, IARC does not look at toxicity, but only evaluates whether there is any association of an exposure or agent to carcinogenicity. Clearly using IARC's groups as a basis for action requires common sense.

That leads us directly to the campaign by some concerned citizens to ban all pesticides in Marin, re-energized by IARC's addition in 2015 of glyphosate to Group 2A (agents or exposures probably carcinogenic to humans). This group includes among other things, eating French fries, potato chips, and red meat. There are good reasons to eat fried foods and red meat in moderation, but a total ban of French fries and steak would be considered silly. A complete ban on glyphosate is an equally bad idea.

Removing a dense patch of French broom is only the first step: viable seeds last for decades in the soil. Photo by Charles Kennard

The only people who show increased cancer risk from glyphosate are farmers and pesticide applicators, both chronically exposed to many pesticides. Glyphosate exposure to the general public comes mostly from eating grains treated with glyphosate, not from weed management on public lands.

Limiting the use of glyphosate on food crops and in keeping lawns free of dandelions and weeds out of sidewalk cracks is an excellent idea. To eliminate herbicides and facilitate the continued spread of invasive weeds in natural lands is a bad idea.

The group galvanized by WHO's change in status of glyphosate has stated that their goal is to ban all pesticides on all public lands in Marin, including County, State, Federal, and Marin Municipal Water District (MMWD) lands. Let's consider the results of a complete ban on herbicides, a subset of pesticides, for public agencies that manage natural habitats in Marin County. MMWD has not used any herbicides to manage invasive weeds for the past ten years. The effect of that action was revealed by the answer when, earlier this year, we asked the General Manager this question: What changes have occurred during the period 2005–2015 in the extent of invasive plant populations?

He replied with these examples: Combined broom species were mapped at 917 acres in 2006, 1148 acres in 2009, and 1372 acres in 2014 with the same technique used each time. Known small weed populations (all species) expanded from 55 patches in 2007 to 164 patches in 2015. A patch is anything under 100 square meters in diameter. The yellow star thistle population at the West Peak expanded from 60 acres in 2007 to 64 acres this year. In the same time period, the extent of yellow star thistle at Rock Spring expanded from 46 acres to 57 acres.

What is at Risk if Weed Control is Ineffective?

Biodiversity: Aggressive invasive plants that crowd out other vegetation, change soil, and deplete populations of invertebrates, fish, and wildlife, threatening this biodiversity.

More Fires: Broom burns readily and carries fire to the tree canopy layer, increasing both the frequency and intensity of fires. Broom has completely filled fuel breaks in Marin's Open Space Preserves, choking out firefighter access along roads and in the wildland-urban interface and creating a maintenance burden.

Marin's Organic Farming: Organic ranches and farms cannot use what are commonly called chemical pesticides. If noxious weeds from Marin County's public lands invade organic pastures, operators of ranches and dairies have few choices. One ranch was forced to give up its organic certification to get rid of the invasive distaff thistles that had ruined pastures.

North Bay Conservation Corps members manually remove non-native cordgrass near Doherty Drive. Photo by Charles Kennard

Your Tax Dollars: Marin County spends more than $1 million each year to mow fuel-breaks in Open Space Preserves and it is losing ground to broom infestations. MMWD spends comparable amounts. Without use of herbicides, that expense will grow. According to the draft vegetation management plan prepared by MMWD several years ago, it would require about $6 million per year, or an additional $100 charged annually for each meter in MMWD's service area, to prevent spread of invasive plants on its watershed without using herbicides.

Threatened and Endangered Species: Threatened and endangered species are already vulnerable. The rapid spread of invasive plants can be the nail in their coffins. A few species at risk of extinction from invasive plants in Marin County include Ridgway's rail (formerly California clapper rail), salt marsh harvest mouse, Tiburon mariposa lily, soft bird's-beak, and cupped monolopia.

San Francisco Bay: The Bay is threatened by four species of introduced cordgrasses, three found in Marin County, along with our native cordgrass. These highly aggressive invaders significantly alter both the physical structure and biological composition of our tidal marshes, mudflats, and creeks. Without use of herbicides, invasive cordgrasses threaten to invade more than 50,000 acres of the San Francisco Estuary.

Effective Flood Management: Invasive cordgrasses clog channels that convey floodwaters. The same thing happens in freshwater reaches when giant reeds block stream flow and fill flood plains.

Quality Recreational Experiences: Walking, riding bikes and horses, birdwatching, taking pictures, or simply enjoying nature is diminished by monocultures of invasive plants.

How Do We Protect Marin's Natural Habitats?

Over the years, Integrated Pest Management (IPM) has been developed as a common-sense decision-making framework for controlling undesirable species. For managing invasive plants in wildlands and open spaces, IPM provides a method for determining which treatment or combination of treatments will be most effective and least harmful to people and the environment in controlling the plants. It is based on knowledge of the species' biology and ecology, the environment, management goals, and the effectiveness of mechanical, cultural, biological, and, where and when necessary, chemical (herbicide) methods.

What Treatments Are Included in IPM?

Pulling and Digging: Pulling works well on seedlings with shallow roots, even for species that cannot be pulled when mature. Larger plants can be removed using tools. However, pulling and digging plants disturbs the soil, leaving an opportunity for invasion by non-natives.

For plants like French broom, with a seed bank that lasts decades, the disturbance from digging and

pulling mobilizes seeds too deep in the soil to germinate, leading to a bumper crop of seedlings during the next growing season. Some plants that sprout from small root fragments cannot realistically be dug,

Mowing and Brush Cutting: Repeatedly removing biomass causes reduced vigor in many weed species. Mowing is most effective when it is performed before the weeds are able to set seed.

However, the biology of the weed must be considered before mowing. Some weed species may sprout with increased vigor after being mowed. Although mowing can be a very successful control method for some annual weeds, this method is usually used in combination with other control methods such as burning or herbicide treatments.

Mulching and Tarping: Mulch is a layer of material that is spread on the ground, often spread on top of layers of cardboard or newspaper. Compared with some other methods of weed control, mulch is relatively simple and inexpensive. Mulching smothers the weeds by excluding light and providing a physical barrier to impede their emergence. Mulching is successful with most annual weeds, however some perennial weeds are not affected. Tarping has been tried on invasive cordgrasses in Hal Brown Park and at Bolinas Lagoon, but it has been virtually impossible to keep the tarps in place when winds and tidal action create gaps and let light in.

Fire: Burning and flaming can be economical and practical methods of weed control if used carefully. In Marin County, burning is applicable only in grasslands away from structures. Burning removes accumulated vegetation by destroying dry, mature plant matter and killing green new growth. Buried weed seeds and plant propagules may also be destroyed during burning, however dry seeds are much less susceptible to the increased temperature; some plants like French broom show enhanced germination after an area is burned.

Goats: Many people think that goats are the ideal weed-control mechanism because of their reputation for eating everything. Unfortunately, goats do nothing more than mow the vegetation. They can clear an area to reduce the risk of fire, but nearly all of the plants they eat, particularly persistent invasives like broom and Harding grass, resprout when winter rains come. Further, goats do not discriminate between desirable vegetation and invasives.

Herbicides: The vast majority of herbicides are used in agriculture. The U.S. Department of Agriculture reports that in 2007 (the most recent data available), approximately 877 million pounds of active ingredients were applied to crops, nearly two-thirds of the pesticides used on corn, cotton, fall potatoes, soybeans, and wheat. These herbicides are applied over wide areas and enter the food supply.

By contrast, land managers of natural habitats in Marin County, unlike some private property owners and landscape maintenance services, use herbicides measured in ounces and under strict controls to ensure that the herbicide is applied only to the target plants. Herbicides are not used frequently nor are they the main method of weed control.

For example, Marin County Open Space has inventoried almost 300 invasive plant species; herbicides have been used or proposed for use on only these five species: pepperweed (at Deer Island OSP), yellow star thistle (Mt Burdell OSP), Harding grass (Ring Mountain OSP), goatgrass (Terra Linda-Sleepy Hollow OSP), and French broom (fuel breaks near homes).

The Invasive Spartina Project has used herbicides in its effort to eliminate four invasive cordgrasses that threaten San Francisco Bay. One focus of the effort has been Corte Madera Creek, where two of the four invasive cordgrasses were introduced when the wetland at Hal Brown Park was restored in the mid-1970s. As the amount of invasive cordgrass has been reduced by 95% during the last 10 years, the herbicide use has dropped. Now, almost all the effort is digging.

Glyphosate, the most commonly used herbicide in upland areas, binds tightly to the plant where it is applied and to the soil directly at the plant. If it does reach water, it degrades very quickly. Imazapyr, used to control invasive cordgrasses (*Spartina* species), subject to tidal action, and pepperweed that grows in damp areas, also degrades quickly in water. Both of these herbicides interfere with photosynthesis and have not shown harmful effects on invertebrates, fish, or wildlife when carefully used.