

Protecting western redcedar from deer browsing—with a passing reference to TRP channels

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This editorial is about tree farming. It proposes to test in an experiment whether co-planting (in the same hole) western redcedar (WRC, *Thuja plicata*) with Sitka spruce (*Picea sitchensis*) protects WRC seedlings from wildlife browsing. This sustainable protection method is an alternative to the traditional use of mechanical devices and big-game repellents. Many repellents contain transient receptor potential (TRP) agonists, such as capsaicin, a TRP vanilloid-1 agonist. This editorial also delivers a puzzle: while herbivores avoid capsaicin, why do

people living in hot climates consume large quantities of it (in chili peppers)?

Why Tree Farming?

Temperature has been designed as a multidisciplinary biomedical journal centered around...well, temperature. Any article that deals with both temperature and life (any form of life) belongs in this journal.¹ While *Temperature's* main focus is on the physiology of thermoregulation, the first issues also included papers covering animal agriculture^{2,3} and wildlife biology,⁴⁻⁶ among other disciplines. However, the main questions faced by today's biological sciences – is life on the Earth threatened by global warming? how do we make our planet cooler and greener? how do we make our life more sustainable? – received only limited coverage.^{5,7}

If one thinks about the greenest concepts of the past century, the concept of tree farming immediately comes to mind. Tree farming replaced the cut-and-run timber-harvesting approach with sustainable tree growing (farming) in a perpetual cycle: planting – active management (which often includes intermediate harvests) – final harvest – planting... On June 12, 1941, the first tree farm in the United States was dedicated in Montesano, Washington. Operated by Weyerhaeuser Timber Company (presently, Weyerhaeuser Company) on a mix of state and private forestlands, this more than 120000-acre (1 acre = 0.004 km² = 0.4 hectare) tract, located just south of the towns of Montesano and Elma, was set aside for testing Weyerhaeuser's fire-control and reforestation theories. The farm was named after Charles H. Clemons, a local logging pioneer. At the dedication ceremony held at the Montesano Theater, Arthur Langlie, Governor of the state of Washington, told

the throng that the Clemons Tree Farm might serve as an example for forestland acres "throughout the state." Little did he know that this tree farm would start the national movement, further propelled by the American Tree Farm System (ATFS), which was established just a few months later. Tree farming rapidly expanded over millions of acres in all 50 states.

To be certified by the ATFS, a tree farmer must meet several standards, including a commitment to practice sustainable forestry, protect fish and wildlife, and promote biodiversity. More recently, tree framers have also been viewed as future important contributors to the mitigation of climate change through forest management for carbon sequestration.⁸

Personal Experience

My wife and I own Tree Fever, a Douglas fir tree farm, which we purchased from Weyerhaeuser. This micro-farm (~140 acres) is located between Elma and Montesano, very close to the original Clemons Tree Farm, and is now ATFS-certified. With the help of forestry professionals, I manage Tree Fever. Soon after we purchased the farm, I started thinking about the narrow strip of land between our main Douglas fir stands and the riparian management zone (RMZ) along the West Fork of Satsop River. This strip was covered with a dense thicket of vine maple, Himalayan and evergreen blackberry, salmonberry, devil's club, and ferns with occasional old (>100 years), colossal Sitka spruce and western redcedar (WRC) trees, along with some western hemlocks, bigleaf maples, and red alders. (Because the WRC and Sitka spruce are the main heroes in this editorial, let me introduce them properly, with their Latin names: *Thuja plicata* and *Picea sitchensis*, respectively.) Many of the old trees in our near-RMZ strip of land were

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Abbreviations: AITC, allyl isothiocyanate; ATFS, American Tree Farm System; OSU, Oregon State University; RMZ, riparian management zone; TRP, transient receptor potential; WFFA, Washington Farm Forestry Association; WRC, western redcedar; WSARE, Western Sustainable Agriculture Research and Education.

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crippled, scarred from lightning strikes, and missing tops. Many were rotten. This 7-acre area was pretty much useless from a tree-farming perspective. Nor did it support any recreational activities. In fact, the area was nearly impassible, especially during summer.

An obvious solution was to perform a rehabilitation harvest in this area, clear it, and plant crop trees. However, the proposed plantation would be partially shaded by Douglas fir trees in the production stands, from one side, and by large trees in the river RMZ, from the other side. Clearly, the light-loving Douglas fir, our main crop, would not thrive there. We needed a shade-tolerant tree. And because both my wife and I liked the WRC, which is shade-tolerant and grows well on our soil, I started thinking about this particular crop.

Western Redcedar

In addition to its beauty and practical uses, no other tree in the Pacific

Northwest has such a tremendous cultural value as the WRC, known to most Americans as “cedar” (even though it does not belong to the genus *Cedrus*). Coastal Washington, Oregon, Northern California, and Alaska used to be covered with WRC forests, and WRC trees of truly gigantic sizes were common (Fig. 1). Native Americans used cedar wood and other products from this magnificent tree for a wide range of applications: from building canoes to weaving clothes (Fig. 2). Totem poles were also made of cedar – this sacred tree was an indispensable participant in the spiritual life of many native tribes. Many applications were later adapted by settlers, and WRC is still widely used today for siding, roof shingles, outdoor furniture, and wood carving.

Currently, tree farmers in the Pacific Northwest, whether small landowners like Tree Fever or industry giants like Weyerhaeuser, grow primarily Douglas fir and

almost no WRC. This is despite the fact that the price for WRC logs is 60% higher than that for Douglas fir logs, and that the WRC growth rate on high-class sites (as at Tree Fever) can be just as high as that of Douglas fir. The main obstacle to the wide-scale adoption of WRC by tree farmers is the tree’s susceptibility to damage by deer, elk, mountain beavers, rabbits (all abundant at Tree Fever), and other wildlife. WRC seedlings are very high on the list of preferred foods for both deer and elk (“deer candy”). Wildlife browsing on newly planted WRC seedlings results in delayed regeneration and often in total plantation failure.

How to Deal with Deer Browsing? “Mechanical” Methods

Two main mechanical methods of protecting young WRC trees from browsing include: (i) herbivore population exclusion by fencing the entire plantation and (ii) protection of individual trees by installing a mesh tube or a similar device around each seedling. Fencing is the option usually chosen by industrial growers, because they can plan for near-round- or square-shape plantations on their large tracts, thus maximizing the number of trees protected by a linear foot of fence and, consequently, minimizing their costs per tree. Fencing is attractive, because it does not require any future work on browsing prevention in the plantation itself (unless a fence fails, and browsers get into the plantation and need to be chased out). Small owners occasionally use fences too, especially when the need for fencing is supported by additional considerations, such as trespassing prevention or pasture delineation. In many cases, however, erecting fences on a small piece of land is not feasible from the points of view of the multi-purpose land use and aesthetics. Furthermore, many small owners try to utilize every piece of their property and often end up having plantations of elongated and irregular shapes. In such cases, fencing easily becomes cost-prohibitive on a per-tree basis.

Among individual protective devices, rigid mesh (“Vexar”) tubes are most common. The tubes are installed around



Figure 1. The so-called “Quinault-Lake Cedar.” This is the largest known WRC in the world, with a 19.5 ft (5.94 m) diameter at breast height and an estimated wood volume of 17650 ft³ (500 m³).⁹ It is located ~50 mi (80 km) from Tree Fever. Photo by Wsiegmund, Wikimedia Commons, reproduced under a CC-BY 2.5 license.



Figure 2. Nuu-chah-nulth (Nootka) tribesman, likely a whaler, wearing traditional cedar-bark clothes, Washington State, c. 1910. Photo by Edward S. Curtis, Library of Congress, Washington, DC.

seedlings at the time of planting. Most owners have a tube installed by weaving a small bamboo stick through the tube's wall and pressing it into the ground. There seems to be consensus, however, that this method provides little protection from elk. Using a larger stick and fixing a tube to the stick with two cable ties (Fig. 3) is recommended if elk migrate through your area.

The major drawback of the tube protection method is that, as the leaders grow, the tubes must be lifted to protect the new growth. Tubes that are pulled out by elk, often together with a stake, have to be reinstalled (if the tree is still alive). These adjustments and repairs should be done at least annually and, preferably, more frequently. Hence, multiple entries in the plantation are required. Since all these entries are made very early in the rotation cycle, during the first years, their financial impact is severe. For example, with a rotation cycle of 55 years, the

modest labor fees of 60 cents per tree for tube installation, adjustment, and repair paid at the beginning of rotation years 1 through 7 would be equivalent to the whopping \$26700 per acre (assuming a planting density of 500 trees per acre and a 5% alternative rate of return; rounded to the nearest \$100). Sorry, I could not resist giving a numeric example.

Big-game Repellents: "Predator Fear"

Another traditional defense against deer browsing is by using big-game repellents. Repellents can be taste-based (an animal has to start browsing on the protected plant in order to experience the unpleasant taste), smell-based, or both. They exploit several physiological mechanisms, including conditioned taste aversion (when an animal learns to associate a certain taste with unpleasant symptoms

caused by a repellent) and neophobia (initial reluctance to digest a food with a novel taste), but the most common mechanism used is "predator fear." The term "fear" was given to the mode of action of repellents that include, as active ingredients, animal products with predator odors or protein degradation products, often sulfur-containing. The anthropomorphic explanation is that volatiles emitted by animal-based repellents are perceived by herbivores as indicators of predator activity.¹⁰ Working with (or even reading about) "fear"-inducing repellents is not for those with a weak heart or stomach: some are made of putrefied (read "rotten") fish carcasses, chicken eggs, blood, or even urine! Furthermore, a plantation sprayed with a blood-derived preparation often looks like a site of a major battle – everything is covered with a stinky, nauseating gore! A popular smell-based repellent that works through the "fear" mechanism is Plantskydd Deer Repellent. Developed in Sweden, this preparation uses blood meal as an active component. A popular smell- and taste-based repellent working through the same mechanism is Seadust Wildlife Controllant. Developed and extensively tested in the Pacific Northwest, this preparation is made of commercially processed seashell residue. Based on published reports (see, e.g., ref. 11), it seems efficacious in protecting multiple species of plants from browsing by deer, elk, rabbits, and hares.

TRP Agonists: What's an Agonist like You Doing in a Spray like This?

What might be of interest to the readers of this issue of *Temperature* – a special issue on the transient receptor potential (TRP) channels – is that there are also repellents that exploit irritation as a physiological basis for deterring browsing. They work by causing burning sensation and pain in the oral and nasal cavities and eyes and triggering tear production (lacrimation, or lachrymation). Not surprisingly to our readers, the active compounds in these repellents are the omnipresent agonists of TRP channels, especially of the V1 (from "vanilloid") and A1 (from



Figure 3. The author installing a Vexar tube around a WRC seedling with two cable ties fixed to a bamboo stick. Tree Fever research plantation, March 2015. This photo and photos shown in figures 4 and 6 are by Nancy and/or Andrej Romanovsky.

“ankylin”). In fact, many plants naturally contain potent TRP agonists,¹² which are a part of plants’ intrinsic defenses against herbivores. It is tempting to speculate that the ability of plants to produce TRP agonists can be harnessed to develop genetically modified browsing-resistant plants. Such browsing-resistant varieties of WRC are apparently under development, but no genetically-resistant seedlings are available yet, at least not to small farmers.

The irritants used in repellents most widely are capsaicin (a TRPV1-agonist) and allyl isothiocyanate (AITC, an agonist for both TRPA1 and TRPV1).^{10,13,14} Capsaicin (8-methyl-N-vanillyl-6-nonenamide) is the principal irritating constituent of hot peppers (genus *Capsicum*).¹⁵ AITC is responsible for the pungent taste of mustard, horseradish, and wasabi and for the associated lachrymatory effect.^{16,17} Interestingly, both compounds are used in my laboratory to study the roles of TRPV1 and TRPA1 in thermoregulation in rodents (see, e.g., refs. 18 and 19, respectively). The thermoregulatory roles of TRPV1 and TRPA1 are also reviewed in the present issue by János Szolcsányi²⁰ and Willem Laursen and colleagues,²¹ respectively. One of the repellents that contains both capsaicin (0.6%) and AITC (0.2%), Get Away Deer and Rabbit Repellent, showed some efficacy in protecting WRC seedlings from deer

browsing, especially during winter, in a study conducted on an experimental plantation near Olympia, Washington.¹⁴

And here is a recipe for a capsaicin-containing home-made repellent posted on the website of the Washington Department of Fish and Wildlife, which I reproduce with minor modifications (Box 1). This recipe contains milk and eggs (which will rot and produce “fear” compounds) and some essential oils (TRP agonists) as odor repellents, Tabasco sauce (read “capsaicin”) and the same essential oils as taste-repellents, and dish soap as a detergent. Egg and milk proteins will also act as adhesives; oils will help dissolve capsaicin and other components. The recipe states that one application lasts for up to 4 weeks in dry weather, but if you live in a deer country, I would not recommend testing the validity of this statement on your favorite flowering bush in your yard. Low concentrations of capsaicin have been shown not to deter deer browsing effectively; concentrations approaching those in food-grade hot sauces may be required.^{13,14} Ginger, garlic, cinnamon, and mustard seeds – all known sources for TRP agonists¹² – are also often mentioned in the literature on repellents, but I will not bother the readers with further details and technical references.

Repellents Aren’t Magic Bullets

Trees sprayed with taste-based repellents often experience substantial damage anyhow, because each individual animal has to taste each individual sprayed tree in the first place – before learning that browsing on this tree is unpleasant. Negative consequences are associated by the browser with the treatment, and not with the plant species. By the time each deer in the “neighborhood” learns that a certain tree does not taste good, there may not be much left of this tree. Smell-based repellents do not work in cold weather, which happens to be exactly when young conifer plantations are at a high risk for damage by deer and elk and at the highest risk for damage by hares and rabbits. Yet another obstacle is that browsing animals, like people, become used (desensitized) to the TRP agonists and eventually learn to not mind a bit of pepper or mustard with their salad. Hence, many experts recommend changing repellents at every application.

In addition to active substances, repellent preparations typically contain adhesives, which make them stick to plants and stay there for up to a few months (see the example shown in Box 1). But even in the case of perfect adhesion (which does not

Box 1. An All-in-One Homemade Deer Repellent

Mix the following in a 1 gal (~4 l) tank sprayer.

- 2 beaten and strained eggs (otherwise, the white strings surrounding the yolk will plug up your sprayer)
- 1 cup milk, yogurt, buttermilk, or sour milk
- 2 tsp. Tabasco sauce (or any extra hot sauce or extract of any chili pepper – the hotter, the better)
- 20 drops essential oil of clove, cinnamon, or eucalyptus (found in small bottles at health food stores)
- 1 tsp. cooking oil or dormant oil
- 1 tsp. liquid dish soap

Top off the tank with water and pump it up. Shake the sprayer occasionally and mist onto dry foliage.

exist), repellents still must be reapplied at least once a year to cover any new foliage. Furthermore, repellents do not stay long enough on leaves in rainy climates. Welcome to the Pacific Northwest! Tree Fever is located only 30 mi (~50 km) from the Quinault Ranger Station, which records annual precipitation levels of ~140 in (356 cm). Why do you think tree farming was born in this area?

Hence, repellents may be a good tool for protecting a small number of plants for a short period of time, but they cannot be relied upon as a single method for long-term protection of plantations. For example, some tree farmers successfully use repellents to spray the tops of the seedlings, the protective tubes, and the bamboo stakes just before the seasonal appearance of elk in their areas. But the largest problem with repellents is not even the efficacy – it is the labor costs. Frequent applications are needed, which requires multiple entries into the stand during the early portion of the cycle – a situation similar to that with Vexar tubes. Could

repeated entries to WRC plantations be avoided, as in the case with fencing? Is there a magic solution?

A Tale about Princess Candy and Her Bodyguard Sitka

After researching for a while the ways to protect WRC seedlings from browsing, I found on the Internet mentions of a non-traditional, sustainable method for preventing deer and elk damage to young WRC trees. This method is to plant a WRC seedling (may I call the seedling “Her Highness Princess Candy” instead of “deer candy”?) together – in the same hole – with a seedling of Sitka spruce as a bodyguard (Fig. 4A). The sharp needles of Sitka will act as a deterrent for browsers – reaching for Princess Candy may not be worth being pricked by the guard’s needles in the snout, lips, and eyes! In contrast to repellents, the guard is not to be washed away by rain. In contrast to the frequent adjustments required for Vexar tubes to

cover the new growth, a cool thing about the new method is that bodyguard Sitka grows as Princess Candy grows and provides more protection when the need for more protection emerges – no adjustments are necessary. What does this mean to tree farmers financially? If we come back to the example I used above (spending 60 cents per tree at the beginning of years 1–7) and get rid of the expenses during years 2–6, the total expense becomes \$7700 per acre, which is a decrease by \$19000 per acre, or by more than 70%. No matter how you play with these numbers (by adjusting the actual labor costs, planting density, and the alternative rate of return), the savings are enormous!

A potential shortcoming of this method is that Candy and Sitka compete with each other for resources, and that this competition can slow down the growth of both. However, the relationship between a princess and her bodyguard sometimes becomes more intriguing than it looks. This is also the case with our Candy-Sitka couple. As both grow, Sitka often becomes less and less competitive. A large percentage of Sitka trees growing at low elevations in Western Washington are attacked by a curculionid weevil, which is prominently present on Tree Fever. This weevil is the most serious enemy of young Sitka in the Pacific Northwest, but it does not affect WRC. The weevil kills or damages the terminal shoots of Sitka, causing deformities.²² After repeated attacks by the weevil, the damaged Sitka, instead of growing up, spreads laterally (Fig. 4B). This shape makes it an even better bodyguard, but also allows the neighboring trees (in our case, Princess Candy) to overtop it. Here we go – a lot of protection with little competition! This tale, however, has a sad ending for the guard. When Princess Candy reaches 6–7 ft or so in height, it no longer needs protection, even from elk, and the bodyguard is no longer needed. At that time, Sitka trees will be clipped, allowing the WRC to grow freely.

This method circulates as an anecdote on some Internet blogs and is well known among tree farmers and foresters. The Extension Service of Oregon State University (OSU) has two postings on their website advocating the method of co-planting WRC and Sitka spruce and urging

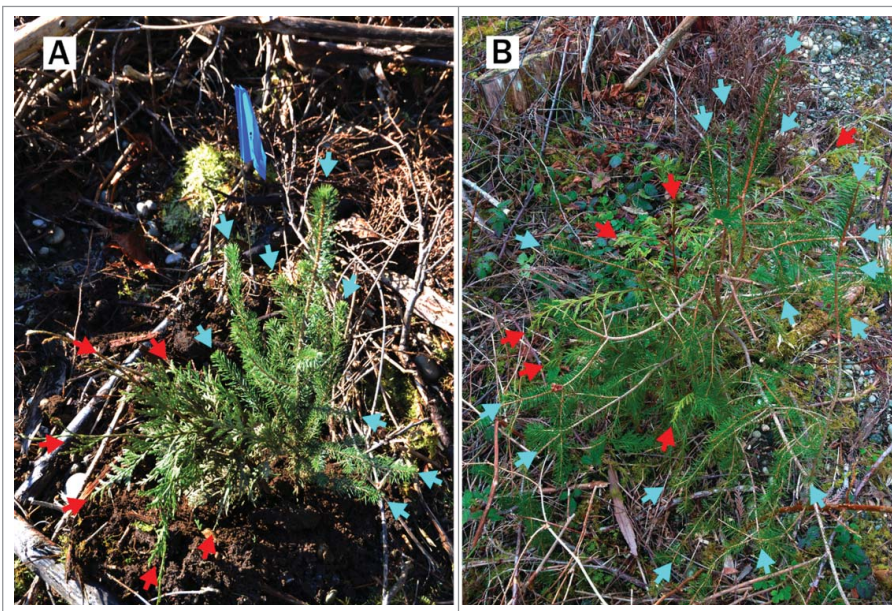


Figure 4. Princess Candy and her guard, Sitka. A seedling of WRC co-planted in the same hole with a seedling of Sitka spruce at the Tree Fever research plantation (A). Young WRC and Sitka spruce that were seeded naturally on Tree Fever in very close proximity to each other, thus resembling co-planting in the same hole (B). In both photos, some branches of the WRC seedling are shown with red arrows, and some branches of the spruce seedlings are shown with cyan arrows. The naturally seeded Sitka is only 2 ft (0.6 m) high, but it already shows deformities, possibly due to weevil-associated damage, even though most Sitka trees are damaged by the weevil after they become 5 ft (1.5 m) high.²²

producers to conduct field studies to test this method. In the fall of 2013, I spoke to Glenn Ahrens, OSU Extension For-ester. He told me (personal communica-tion) that he had visited a beautiful mature WRC stand planted using this method by an Oregon farmer some years ago. Glenn also told me that OSU had two 4-year-old experimental sites in Northwestern Oregon, where WRC was planted either alone (on one site) or co-planted with Sitka (on the other site). According to Glenn, the method was working, but no quantitative data were available yet at the time of our discussion.

Port Blakely Tree Farms, a timber company, also tested this method. Accord-ing to the materials produced by the Washington Farm Forestry Association (WFFA), Mike Warjone, Port Blakely Sil-viculture Manager, talked about this method at the October 2013 meeting of the South Sound WFFA Chapter. The Chapter's newsletter does not contain any quantitative data, but it informs the read-ers that the method did not work. Inter-estingly, it says that "sometimes it was the spruce [and not WRC] that was browsed." Wouldn't this be a success if a deer tried browsing on a spruce and then left – with-out touching the guarded WRC seedling?

Many forestry professionals and growers have an opinion about this meth-od's efficacy – tree farmers are an opinion-ated bunch! But what do we really know about the efficacy of this method?

Is Sitka a Good Bodyguard?

For some reason, when tree farmers talk about protecting WRC from deer browsing, they often think in a bipolar mode: either something saves trees from damage, or it fails. Real life is richer than our expectations. Whether sprayed with TRPV1 agonists or co-planted with a prickly Sitka, a WRC seedling still remains accessible to deer and edible. Hence, no 100% protection should be expected. The question is whether the position of WRC trees growing on a par-ticular plantation can be moved somewhat down on the list of foods preferred by wildlife is that particular area. How far down it needs to be moved also depends

on how much browsing pressure the trees are subjected to. If a gang of elk selects a small WRC plantation as their main campground for a week or two, it really does not matter what mode of protection was used – unless the trees were placed in large metal cages staked to the ground (and some farmers do exactly that!), all WRC seedlings will become "elkpies." On the other extreme, if the browsing pressure is limited to a single visit by a squirrel to the plantation, to taste some king bolete mushrooms growing among the seedlings, any method of protection (including no protection at all) will produce perfect results.

With this in mind, one may evaluate a story about a success or failure of the co-planting method on a particular planta-tion differently. Was the discussed planta-tion subjected to no browsing pressure at all or to an extremely high browsing pres-sure? Could the traditional protection method with Vexar tubes work where the co-planting method seemingly failed? From what I understand, none of the co-planting projects I am familiar with used different modes of WRC protection on the same site. If two different sites were compared, the differences could have been due to unaccounted site-specific factors. For example, a site on which co-planting with Sitka was used could have been located closer to or farther away from a residence with dogs than the site where WRC was planted by itself. Or one of

these sites, but not the other, could have been located on an elk migration route. A test with a different design is clearly needed.

Proposed Research

Last year, I submitted a grant proposal entitled "Sustainable method of protect-ing WRC from deer browsing" to the Western Sustainable Agriculture Research (WSARE) and Education program sup-ported by the National Institute of Food and Agriculture and the US. Department of Agriculture. I proposed to test how efficacious the co-planting with Sitka spruce method was, as compared to both the traditional protection with Vexar tubes and no protection at all. To elimi-nate any site-specific effects on experi-mental groups, I proposed using all three protection modes within the same site, the narrow strip of land on Tree Fever described at the beginning of this article. The grant was funded, and the work began.

In July of 2014, the old Sitka trees were removed from this strip of land (Fig. 5), and the thickets of vine maple and devil's clubs (Fig. 6A) were cleared. Then in March of 2015, the experimental planta-tion was established (Fig. 6B). 1800 WRC seedlings were planted without any protection, each marked with a red flag. Another 1500 WRC seedlings were



Figure 5. This rotten Sitka spruce was removed from Tree Fever during the 2014 rehab harvest. The tree had an 8.9 ft (2.7 m) diameter at breast height. Photo courtesy of David Houk.



Figure 6. Before and after. Low-grade hardwoods in the narrow strip of land between the West Sat-sop RMZ and main Douglas fir stands before the rehab harvest (July 2014) (A). The thickest trunks in the front have a diameter of ~1.5 in (4 cm). After the harvest, site preparation, and planting, this strip of land became a WRC research plantation (March 2015) (B).

protected with Vexar tubes and marked with yellow flags (Fig. 3). And yet another 1800 WRC seedlings were co-planted with Sitka spruce seedlings and marked with blue flags (Fig. 4A). Similar to the WRC, Sitka is a shade-tolerant tree and it should do well on this plantation. These three modes of protection were intermixed (Figs. 3,6B). We will test quantitatively, on the same site, whether the co-planting method works, and whether it works better or worse than Vexar tubes under our conditions. Without quantitative data from studies like this one, it is just too risky for tree farmers to start WRC plantations that take a half a century to grow!

On our new plantation, damage to WRC from deer browsing was noticed already within a week after planting, and within 3 weeks it became substantial.

Knowing how much work was involved in the project, I wondered whether, instead of testing Sitka's ability to guard Princess Candy, we should have made metal cages and sprayed them with the hottest, spiciest sauces we could find! Wait a minute, why do people make such sauces? Do they eat them?

Why Do Some Feast on Repellents?

By tradition, I include puzzles in my editorials for *Temperature*.^{1,23,24} The puzzle for this editorial was proposed by Arpad Szallasi, Guest Editor for this special issue on TRP channels (see ref. 25 for his and his coauthors' editorial). Here is what Arpad sent me: "Why do

people living in hot climates consume more hot pepper than those living in the North? Yes, I know, gustatory sweating... But are you satisfied with this answer? I am not." This puzzle may not be entirely fresh, as the Internet is full of discussions on this topic. But the main idea of this editorial – co-planting WRC with Sitka spruce – is not original either. In both cases, you can find a variety of opinions, but can you find a satisfactory answer? Here is, for example, one opinion from an article about spicy foods published by *The New York Times*: "In general, hot, spicy foods are stimulants. They ... raise body temperature. If you are living in a hot climate, the increase in body temperature can make you feel cooler..."²⁶ I was reading this excerpt while working on the present editorial. "Oh deer!" I thought. As with the previous puzzles, *Temperature* looks forward to receiving your answers and publishing the winning explanation. The Letter to the Editor format seems to work well.^{27,28}

Disclosure of Potential Conflicts of Interest

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