March 24, 2017

Testimony in support of SB 789
Senate Committee on Environment and Natural Resources

Chair Dembrow and members of the committee,

I write in support of SB 789, requiring a public utility to file bond with the State Department of Agriculture if commercially growing or contracting for commercial growing of *Arundo donax* L. or invasive species for use as biomass.

My name is Kevin Weitemier. I am a proud member of the Native Plant Society of Oregon, and recently received a doctoral degree from the Botany & Plant Pathology department at Oregon State University.

Arundo donax is extremely aggressive. In areas where it has become established it forms monocultures that exclude native plants and animals, clogs stream channels, and uses large amounts of water that otherwise would remain in streams.

The planting of *Arundo donax* in Oregon poses a grave threat to the state through its very high likelihood of escaping cultivation and catastrophically invading Oregon's natural ecosystems. Studies of the physiology of *A. donax* conclude that this plant can grow well in Oregon and likely poses a threat of invasion:

> "These findings suggest that it is unlikely *A. donax* will be constrained by the agricultural setting, and therefore cultivating it will disperse it to new environments and will likely lead to future invasions." (Nackley, 2012)

Even the study performed by the OSU Extension Center in Hermiston demonstrates the propagation potential and cold hardiness of *Arundo* plantings already in Oregon. While the executive summary of this study declares that *Arundo* becoming established inadvertently is "unlikely," facts within the report itself sharply contradict this conclusion. The study identifies multiple types of material by which *Arundo* can propagate and, critically, the study shows that *Arundo* can successfully survive the cold winter temperatures of north-central Oregon.

The Extension Center study identifies several forms by which *Arundo donax* might escape from cultivation and spread from feral populations. While stored or dried material may have reduced viability, this study demonstrates that nearly any fresh material, canes or rhizomes, has the potential to propagate:

- **Whole buried rhizomes:** It is, of course, known that whole rhizomes have a very high chance of sprouting as they were the means by which the test fields were planted.
- **Larger pieces of rhizome**: While the study did not find viability in very small pieces of rhizome, the authors caution that larger pieces, approximately two inches in diameter, could be viable.
- **Pieces of fresh cane:** The authors conclude "that planted fresh cane with nodes has a 100% chance of establishment when in contact with cool moist soil for 15 to 30 days." (p. A26)
- **Fresh whole cane** was also shown to sprout, even if it was only lying on the soil surface. "...the experiment does show that cane is viable at low percentages when covered with soil and may have limited viability when laying on the surface.... **all fresh cane should be regarded as having sprout potential** and treated accordingly." (p. A28, emphasis added)

This study did not investigate the effect of storage on rhizome viability, but the rhizome serves as a storage organ and other studies report that 50% of rhizomes stored for four months under moist conditions sprouted (Boose & Holt, 1999).

The cold winters of north-central Oregon have been listed as an environmental factor limiting the viability and spread of *A. donax*. However, this study demonstrates that cold winters only kill *A. donax* if the canes have been harvested before the plant has had time to enter dormancy, with little effect on plants where canes were harvested later.

> "The winter of 2013–2014 was one of the severest in a decade with temperatures dropping below 0° F several times without snow cover. Fields where the *Arundo donax* was harvested while dormant displayed **no significant winter kill**." (p. A33, emphasis added)

A feral population, of course, would not have any cane harvesting at all, allowing rhizomes to maximize their storage potential, resprout, and increase stand density.

Finally, the authors find that "plant survival was better with higher planting density. Survival increased at an increasing rate with higher plant density." This density-dependent survival implies that once *Arundo* gains a toehold in a new populations it may persist for some time while densities slowly increase, and then reach a point where survivability is high and rapid expansion occurs.

Far from allaying concerns about *Arundo* becoming an invader within Oregon, this study has reinforced them. Portland General Electric has stated that their trials of *Arundo* may not work out for using it as a biofuel in Boardman. However, whether or not *Arundo* will grow sufficiently for PGE's needs, it is clear that it has the potential to grow and survive in a manner sufficient to become invasive.

Enhanced *Arundo* poses an even greater threat

Finally, I would like to call your attention to a small sample of research and patents related to the breeding or genetic modification of *Arundo donax*.

The following documents demonstrate that research to further enhance the performance of *Arundo* is active and underway. While the escape of standard *Arundo* would have terrible consequences for Oregon's ecosystems, that damage would only be enhanced if the escaped plants were bred or modified to be even more vigorous and hardy.

In addition, some work on *Arundo* is attempting to modify the plant to be more useful for applications beyond biofuel, including its use for ethanol production and as a feed for livestock.

In the future it may not be only PGE that has an interest in planting *Arundo* in Oregon, and the *Arundo* that is planted may be even more dangerous to Oregon's ecosystems than current varieties.

I ask the committee to do everything it can to discourage the planting of *Arundo donax* in Oregon and ask you to support SB 789.

Thank you for the opportunity to comment on this important matter. Please, don't let *Arundo donax* become Oregon's next English ivy, Himalayan blackberry, yellow star thistle, or creeping bentgrass.

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Arundo donax breeding & genetic modification

Enhance vigor/hardiness

Cold Tolerance

Patent Application 20100115670 (Christensen 2010)

Patent Application 20140245474 (Christensen et al. 2014);

Dan, Y. and A. Kekkonen. 2014. Development of Regeneration and Mutagenesis Systems for *Arundo donax*. *In Vitro Cellular and Developmental Biology – Animal* 50: S55

Antal, G., E. Kurucz, M. G. Fári, and J. Popp. 2014. Tissue culture and agamic propagation of winter-frost tolerant 'Longicaulis' *Arundo donax* L. *Environmental Engineering and Management Journal*. 13(11): 2709-2715.

Low Light tolerance

Low light tolerance allows plants to grow even more densely together.

Patent 8,344,210 (Kwok et al., 2013)

Patent Application 20130191941 (Kwok et al., 2013)

Low-nitrogen tolerance

Tolerance to low nitrogen levels allows plants to grow in poor soils.

Patent Application 20140289884 (Nadzan et al. 2014)

Drought and heat tolerance

Patent Application 20110023193 (Christensen et al., 2011)

Oxidative stress tolerance

Oxidative stress can be related to several other environmental stressors such as heat, drought, and freezing.

Patent Application 20110265199 (Zhou 2011)

Broad applications

Both patents 8,344,211 (Alexandrov et al., 2013) and 8,362,325 (Troukham et al. 2013) include *Arundo donax* and several traits including photosynthetic capacity, shade avoidance, cold tolerance, drought tolerance, water use efficiency, stress tolerance, and vigor.

Enhance use for other applications

Staygreen phenotype – feed for livestock

Leaves retain chlorophyll and protein after senescence (dying), this enhances protein content for ruminent digestion.

Patent 8,779,235 (Zhao et al., 2014)

Reduced lignin content – feed for livestock, biofuel, ethanol production

Reduces lignin (main component in wood, indigestible), increases carbohydrates.

Patent 8,901,371 (Shen et al., 2014); 8,796,509 (Zhao et al., 2014)

Additional references:

Bechtold, N., Hornbeck, D., and Wysocki, D. October 1, 2014. Agronomy of *Arundo donax* in North-Central Oregon. Oregon State University, Hermiston Agriculture Research and Extension Center.

Boose, A.B. and J.S. Holt. 1999. Environmental effects on asexual reproduction in *Arundo donax*. *Weed Research* 39:117-127.

Nackley, Lloyd L. 2012. Ecophysiology as a tool for evaluating invasive-plant based bioenergies: physiological and ecological case-studies of Arundo donax and Elaeagnus angustifolia. PhD dissertation. University of Washington. Seattle, WA. http://hdl.handle.net/1773/21977