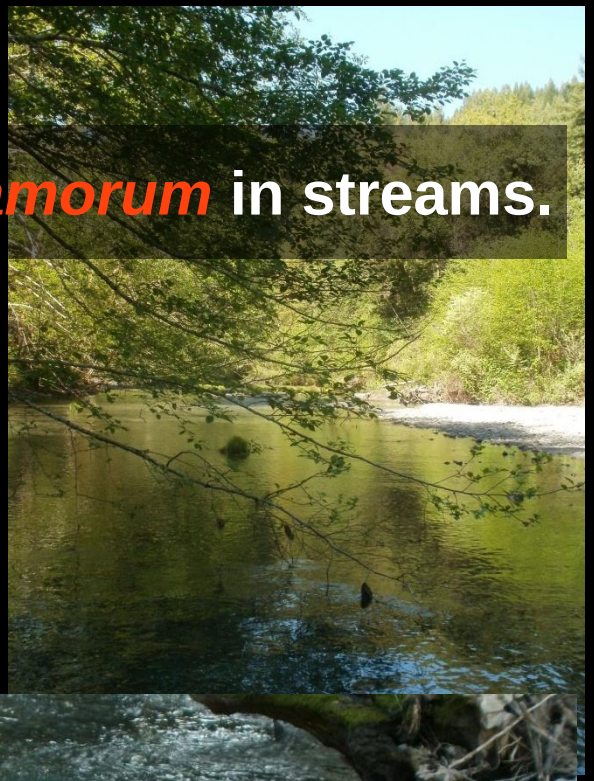
What's it doing in the water?

An overview and insights on the ecology of *P. ramorum* in streams.

Kamyar Aram & David Rizzo, UC Davis



Stream monitoring:

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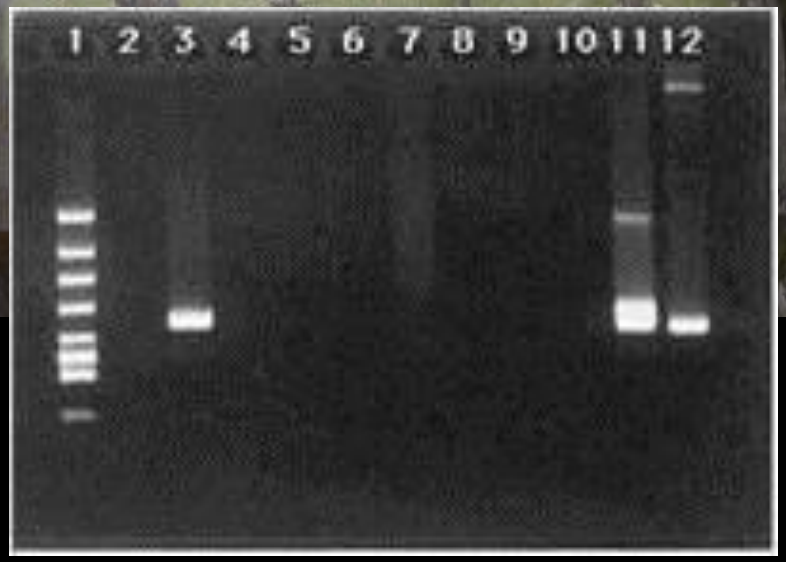
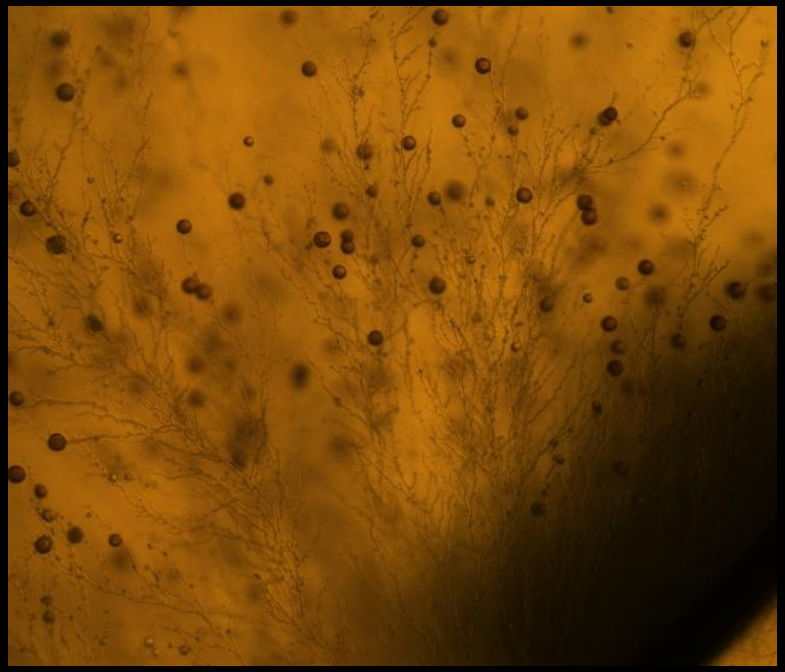


Why is *P. ramorum* in streams?

How much is there?

Where is it coming from?

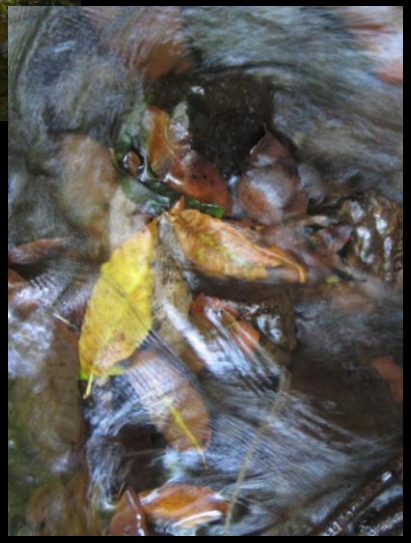


Can it spread this way?

Why is *P. ramorum* in streams?

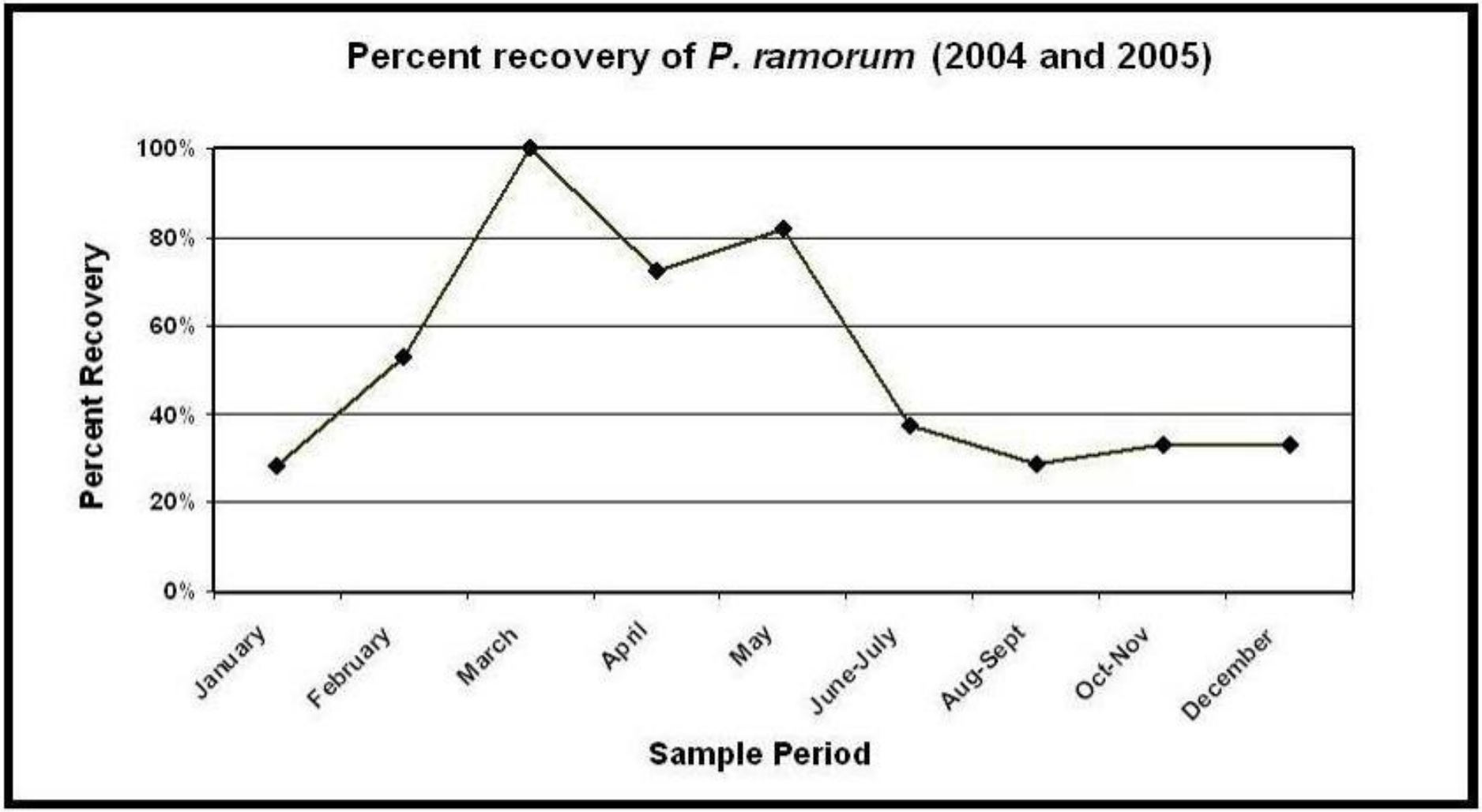
Potential sources:

1. Terrestrial run-off
2. Aquatic & riparian plants
3. Litter & debris



Why is *P. ramorum* in streams?

1. Terrestrial run-off


Percent recovery of P. ramorum (2004 and 2005)
Percent Recovery
100%
80%
60%
40%
20%
0%
January
February
March
April
May
June-July
Aug-Sept
Oct-Nov
December
Sample Period

Why is *P. ramorum* in streams?

1. Terrestrial run-off

***P. ramorum* in water**
not known on land.

Drainage pond, McKinleyville, Humboldt Cty

Little River, Mendocino coast

Why is *P. ramorum* in streams?

2. Aquatic & riparian plants

Why is P. ramorum in streams?

2. Aquatic & riparian plants

Survey:

- Salal (*Gaultheria shallon*)
- Willow (*Salix* sp.)
- Alder (*Alnus rubrum*)
- Elderberry (*Sambuca* sp.)
- various *Ribes* sp.
- Brooklime (*Veronica americana*)
- Buttercup (*Ranunculus repens)*
- Saxifrage species
- Hedgenettle (*Stachys* spp.)
- Coltsfoot (*Petasites palmatus*)
- various ferns
- Horsetail (Equisetum sp.)
- grasses, sedges, & rushes

… and more.

Why is P. ramorum in streams?

2. Aquatic & riparian plants

New riparian host:

Woodwardia fimbriata
(Chain fern)

Why is *P. ramorum* in streams?

3. Vegetative litter

Why is *P. ramorum* in streams?

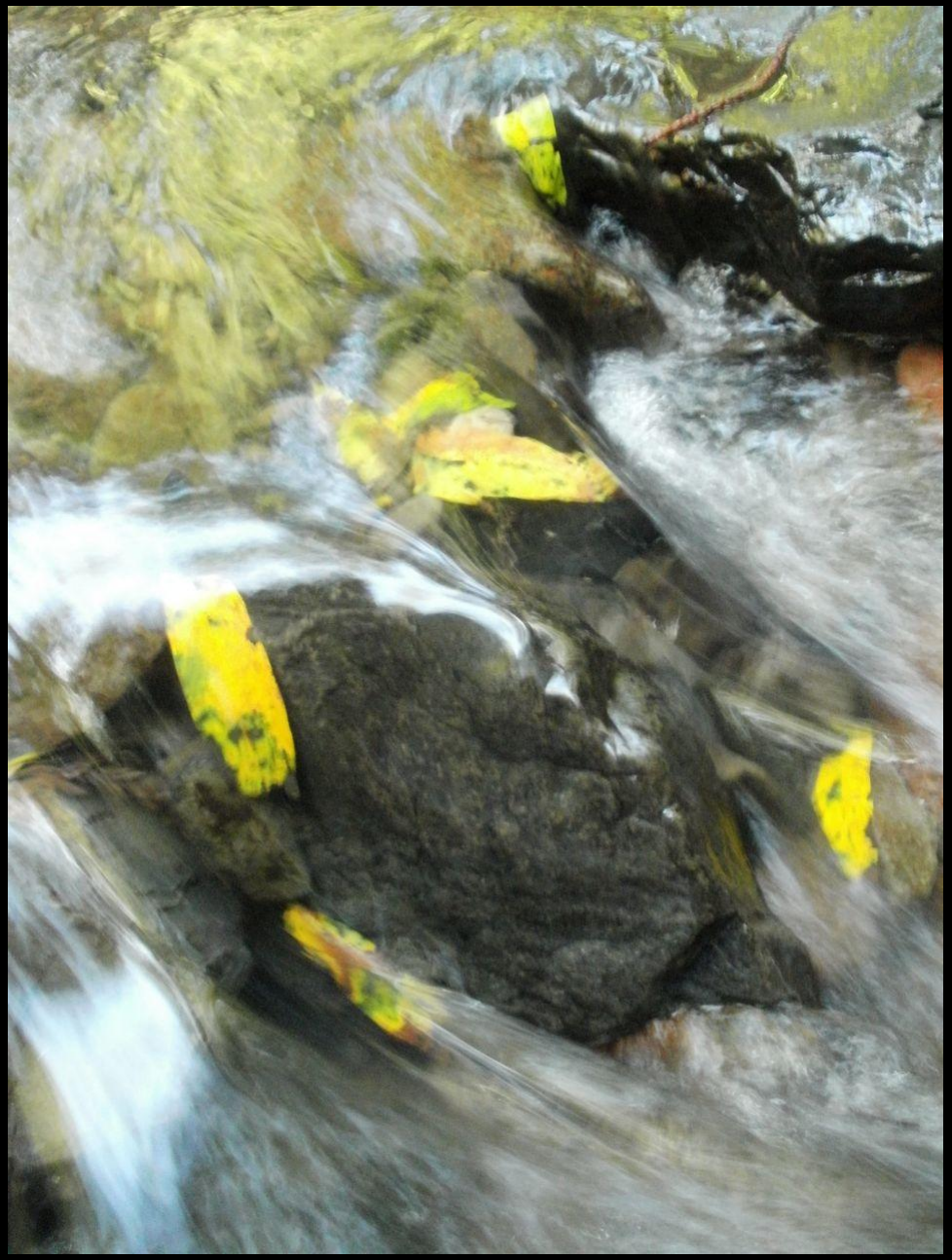
3. Vegetative litter

- infected on the tree?

- infected in the stream?

(like baits)

- how do spores find baits (or litter) in flowing water?



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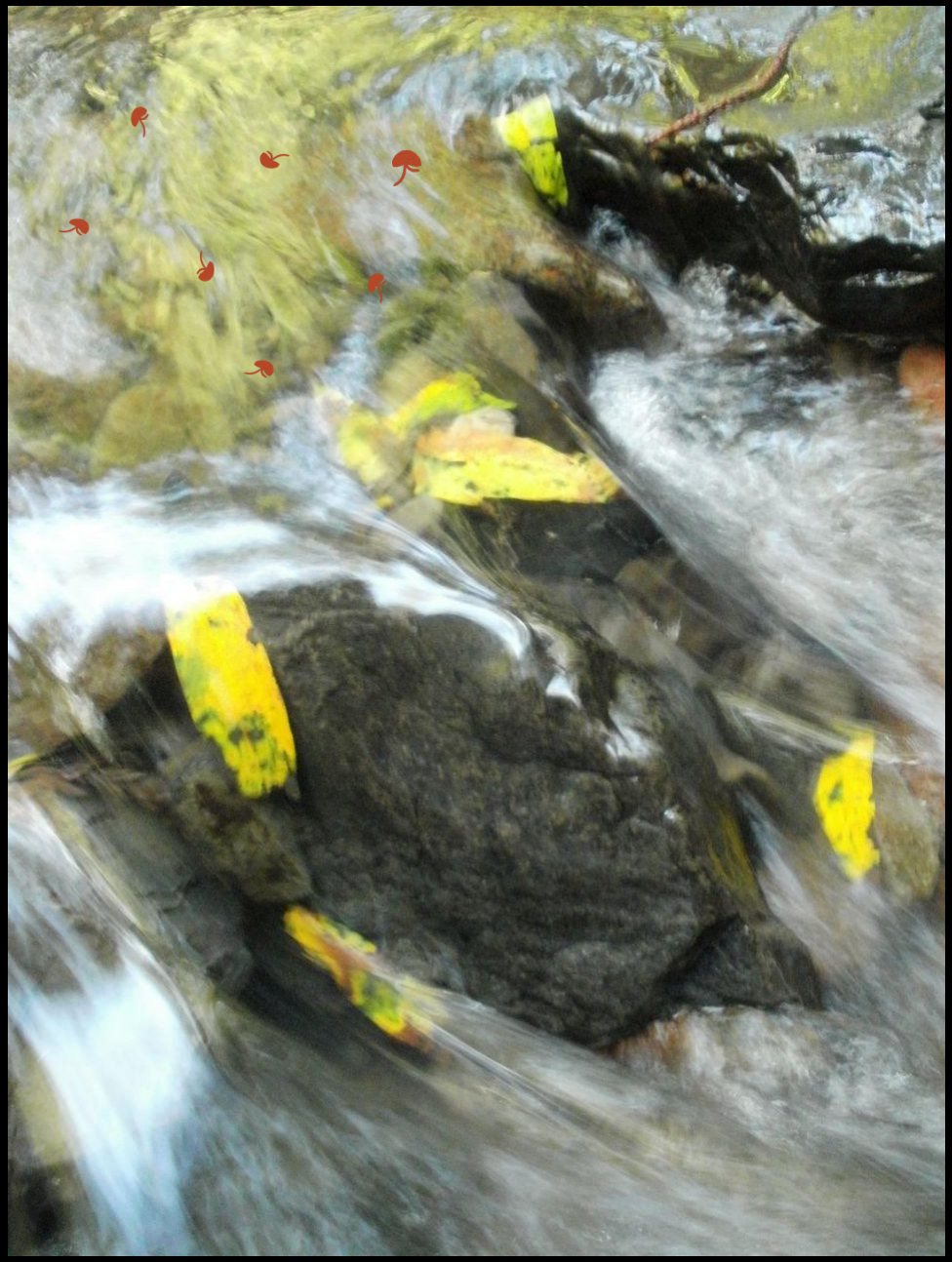

Glass “baits”

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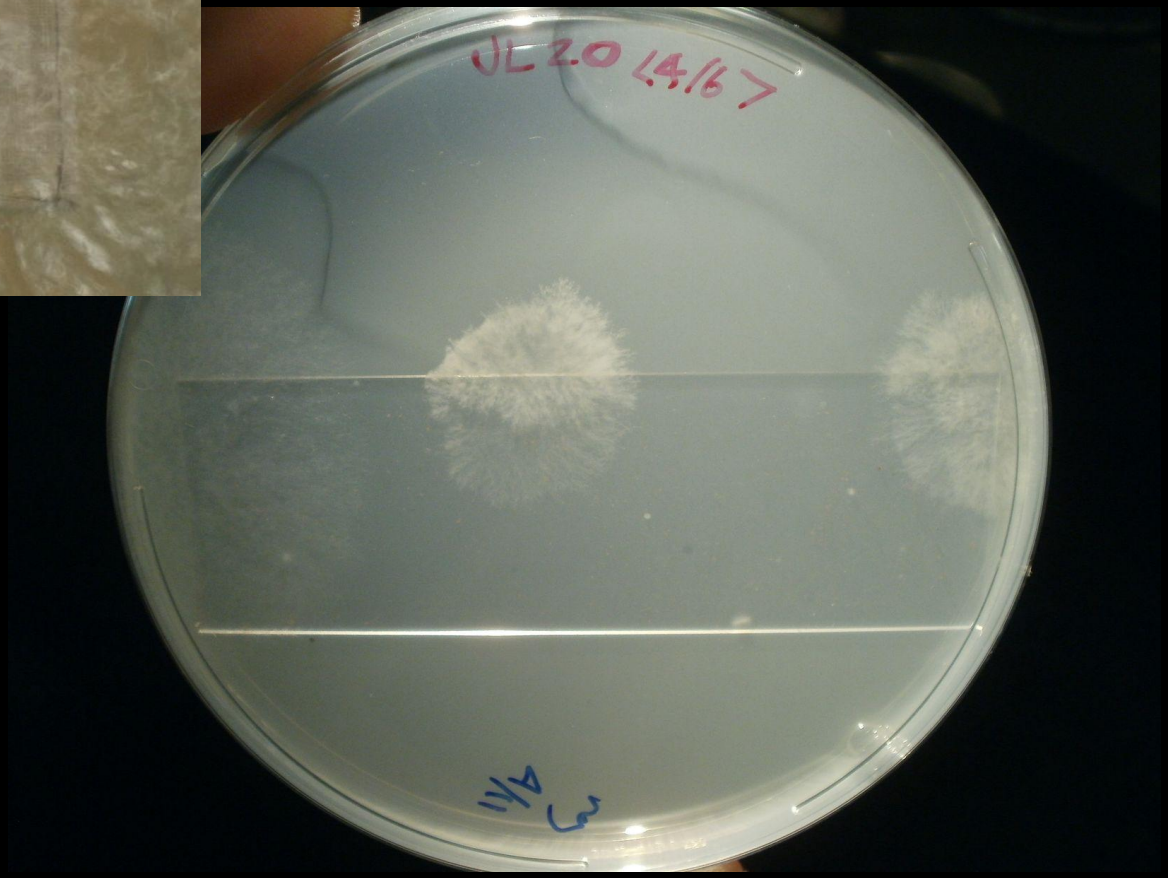
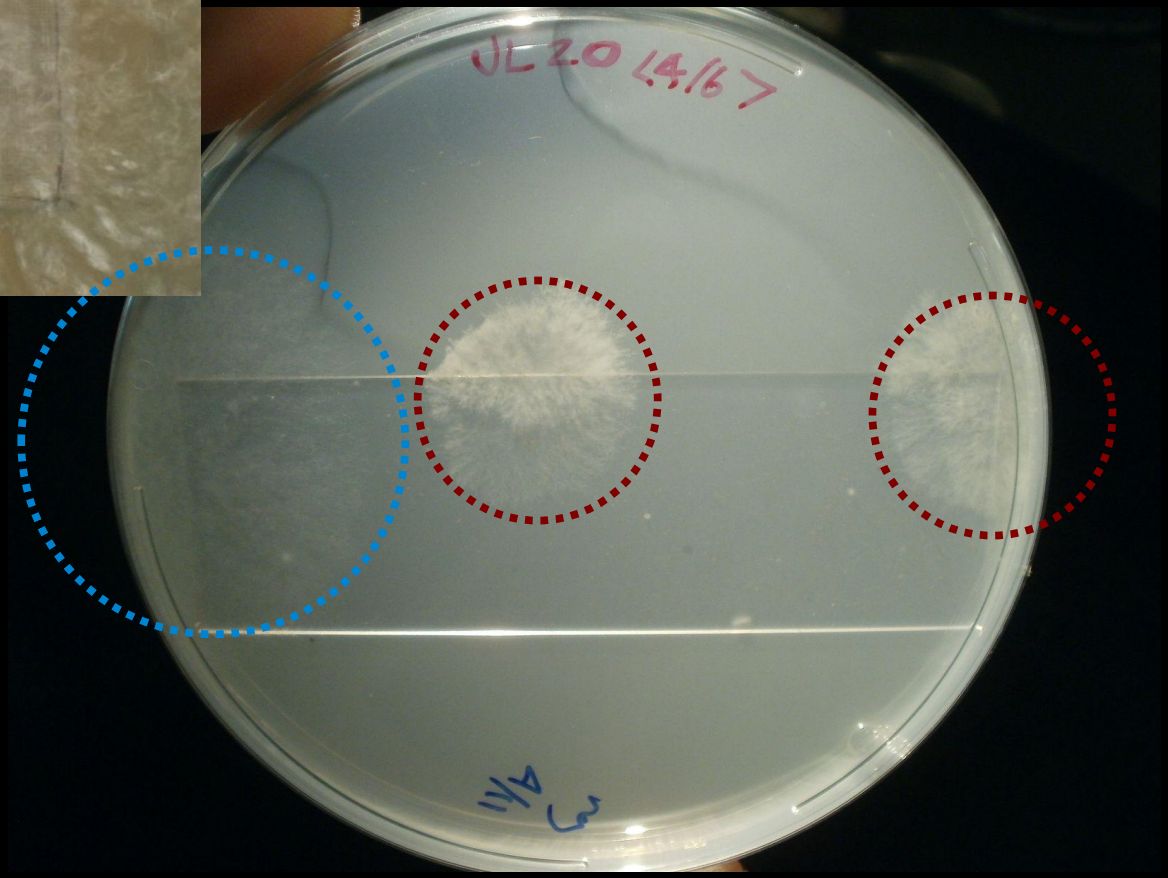
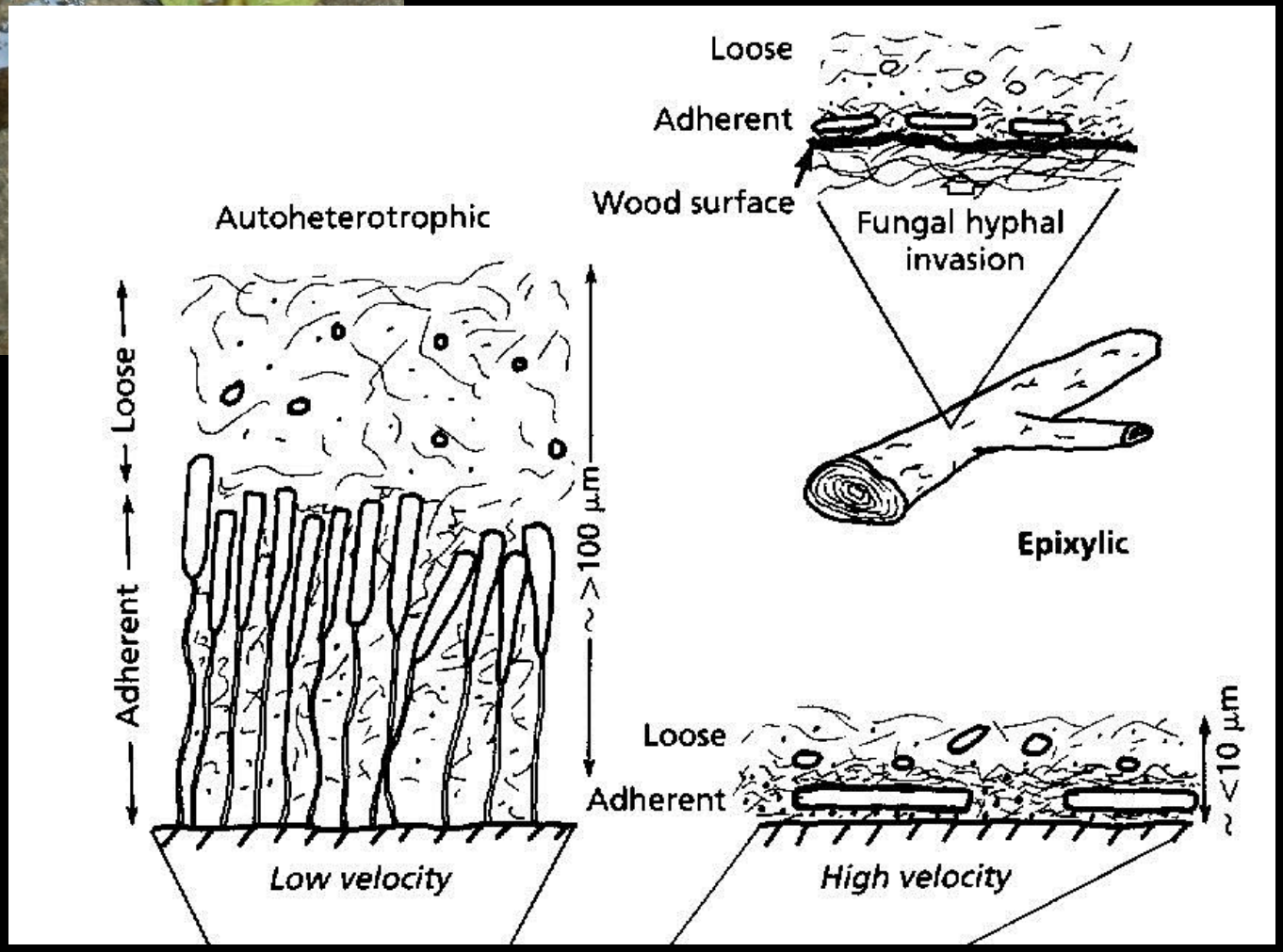


Glass “baits”





from Ford, T.E. *Aquatic Microbiology.* 1993. Blackwell Scientific

Why is *P. ramorum* in streams?

3. Vegetative litter

Mostly senescent, decaying...

…can *P. ramorum*
compete with saprobes?

In stream experiment:

	Dry	Frozen	Fresh
Pr	**0%**	**0%**	**74%**
Other	66%	64%	63%

Percent of 150 total each of dry, frozen or fresh rhododendron leaves placed in Sonoma County streams for 3 week intervals

Fresher bay laurel litter from infested stream.

P. ramorum *P. gonapodyides* No Phytophthora

Fresher bay laurel litter from infested stream.

P. ramorum *P. gonapodyides* **No Phytophthora**

Degraded bay laurel litter from infested stream.

P. ramorum *P. gonapodyides* **No Phytophthora**

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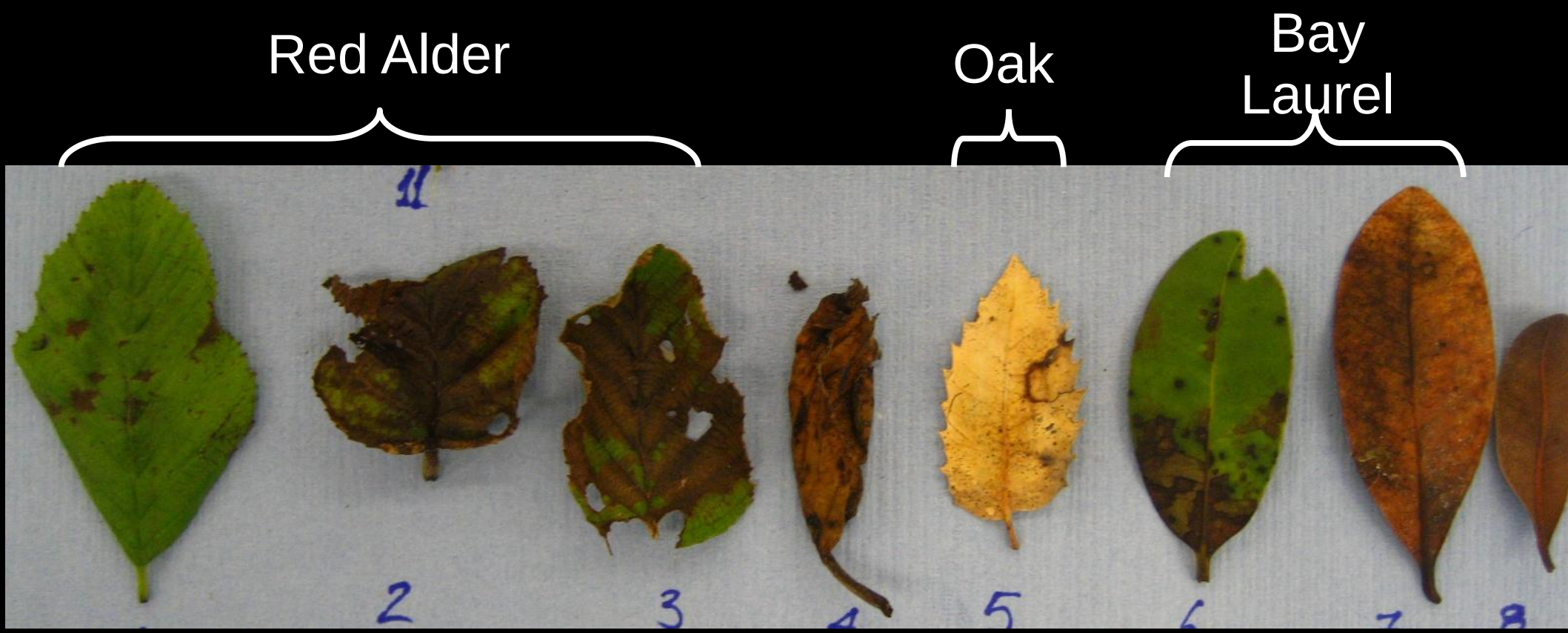
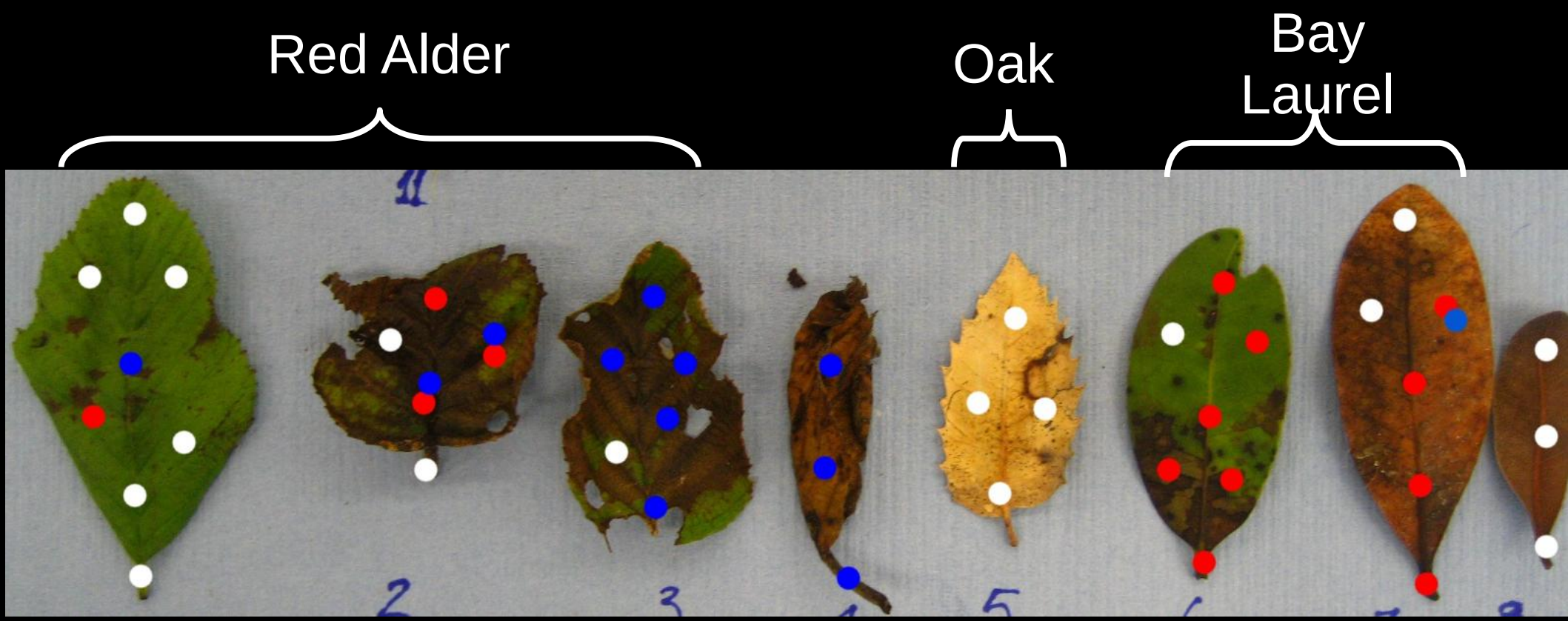


Miscellaneous leaf litter from infested stream.

P. ramorum *P. gonapodyides* **No Phytophthora**



Miscellaneous leaf litter from infested stream.

Mostly bay laurel litter from low infested Humblodt stream

Mostly bay laurel litter from low infested Humblodt stream

P. nemorosa *P. gonapodyides* **No Phytophthora**

Why is *P. ramorum* in streams?

3. Vegetative litter

Infected litter carries Phytophthora downstream.

- a source of spores?

Why is *P. ramorum* in streams?

Summary:

- No *P. ramorum* from riparian plants.
- *Woodwardia fimbriata* infected in stream.
- *P. ramorum* not competitive to infect dead leaves.
- It may persist on already infected leaf litter.

Future work:

- Further examine aquatic & riparian plants
- Sporulation from plants & litter?
- population differences between land & water?
- how do *P. ramorum* spores function in streams?

Why is *P. ramorum* in streams?

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