

Drought and pests...

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UC
CE

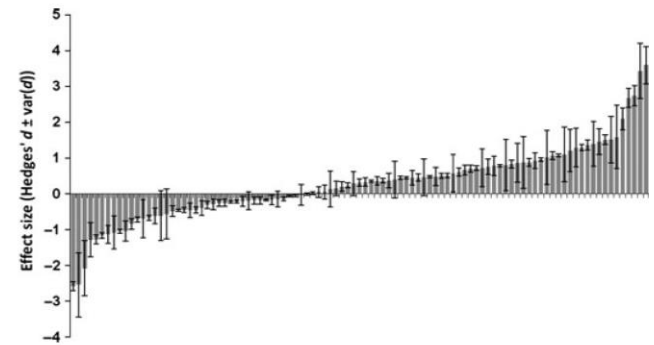
University of California
Agriculture and Natural Resources

Cooperative Extension

CISR, UC Riverside



...main ideas



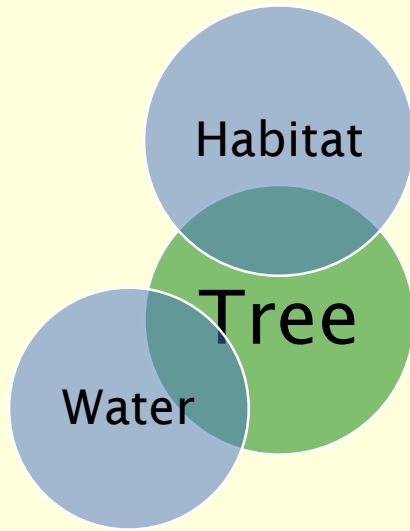
NOT a straightforward relationship...

- ~ drought hurts trees, but it may hurt pests *as well*
 - the relative hurt matters
- ~ long severe droughts are always bad
 - but the effects may not show immediately
- ~ pest details (“lifestyle”) and timing matter a lot

Things to know

- The drought, its duration and severity
- The tree, its history, prior condition, any management
- The major pests

Overview



The interaction of drought
and pests... illustrated with
Old problems



New problems...

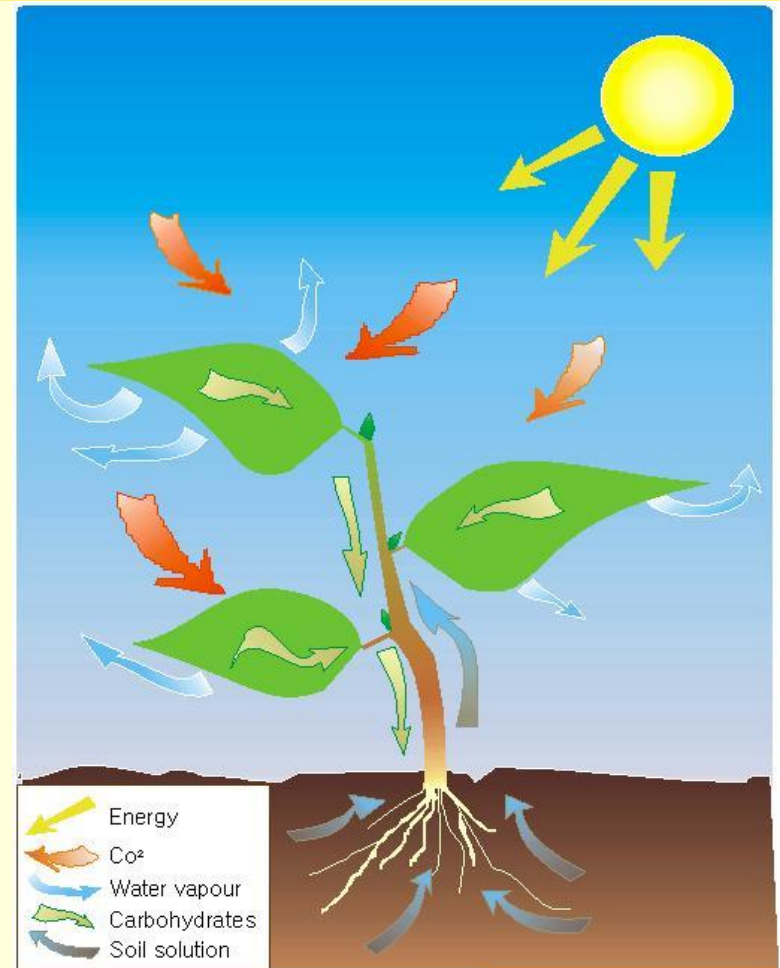
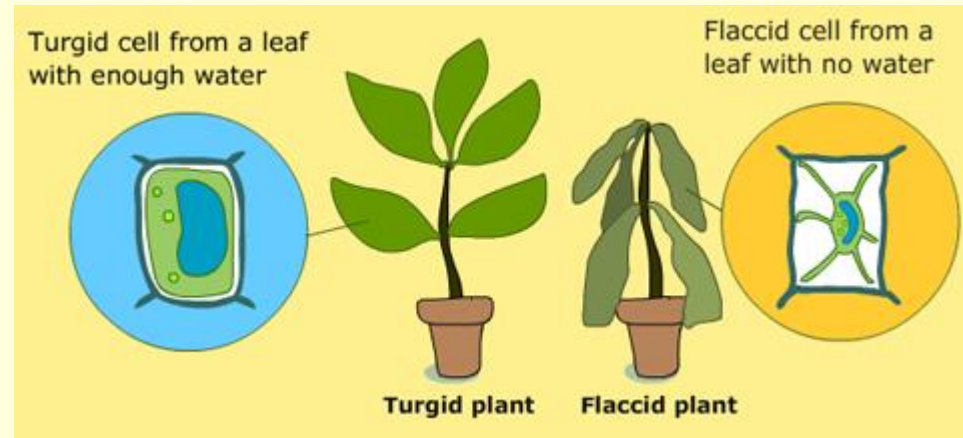
Plants need water...

1) Turgor

2) Transport of solutes

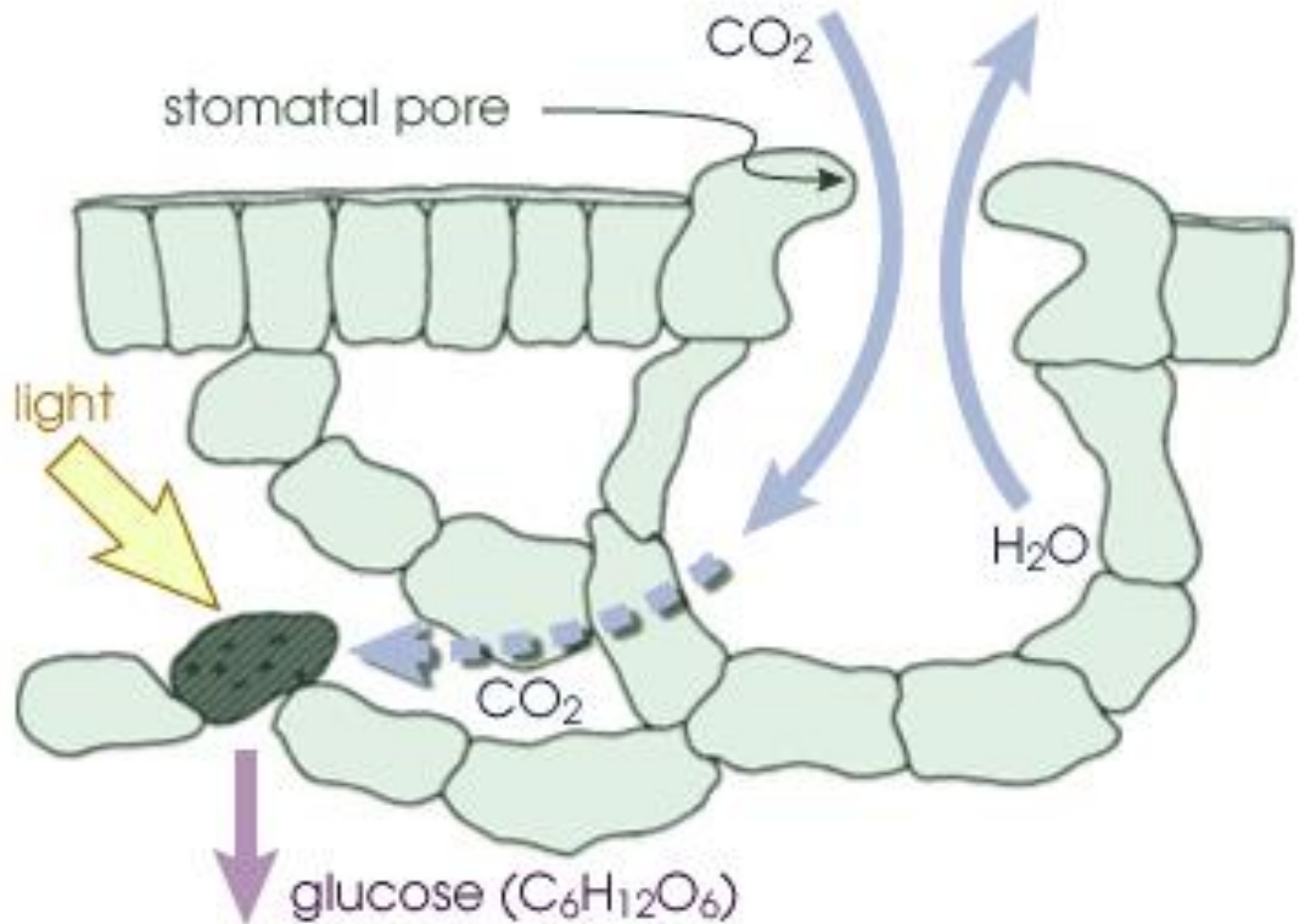
3) Photosynthesis

(make sugar →
then convert it to other
useful chemicals!)



Photosynthesis: CO_2 in, water out

plants
use water
to
“make
food”



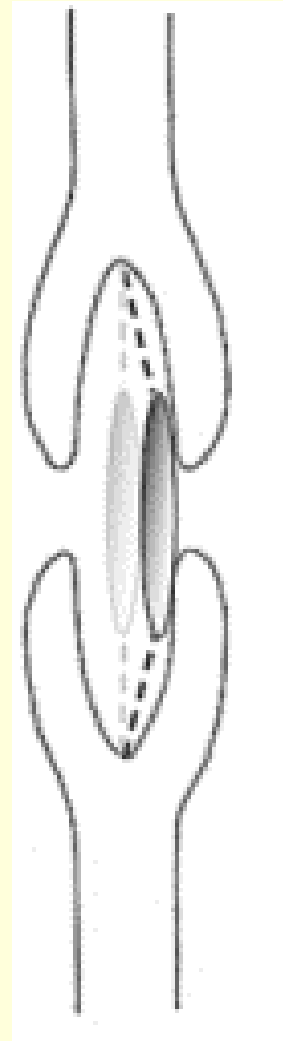
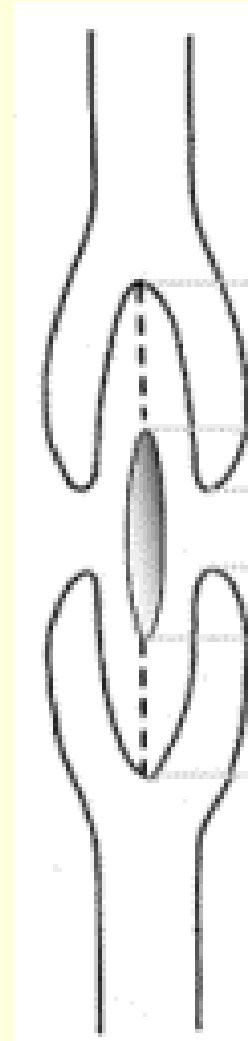
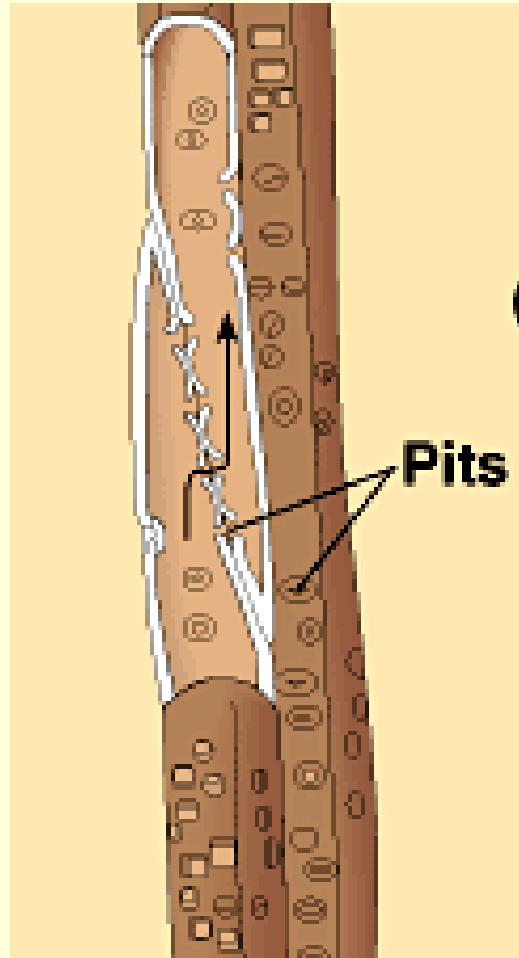
Trees and drought: thirst kills...

Air intrusion in xylem = embolism

→ loss of water conduction

→ death

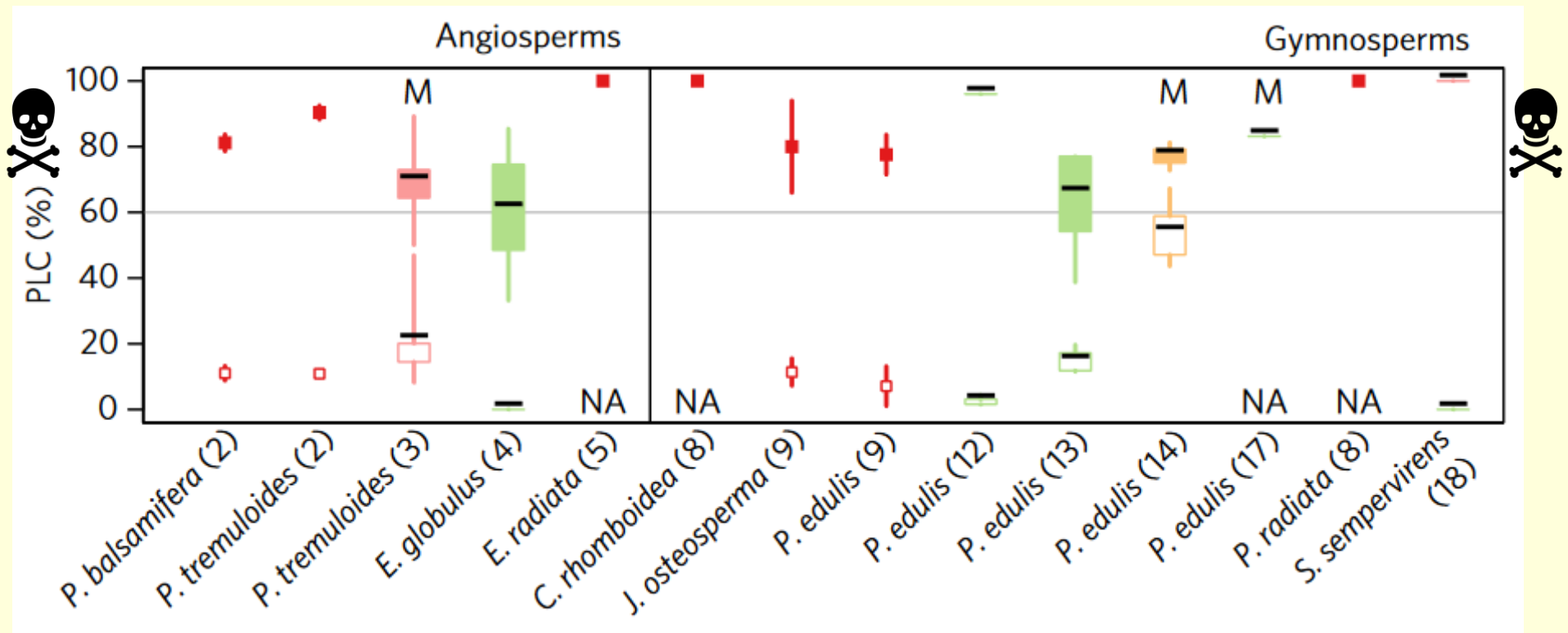
~ trees do their best to prevent this!



Trees and drought: thirst kills...

Air intrusion in xylem = embolism

→ >60% loss of water conduction = death





Water deficit reduces growth rate and causes undersized leaves and shoots.

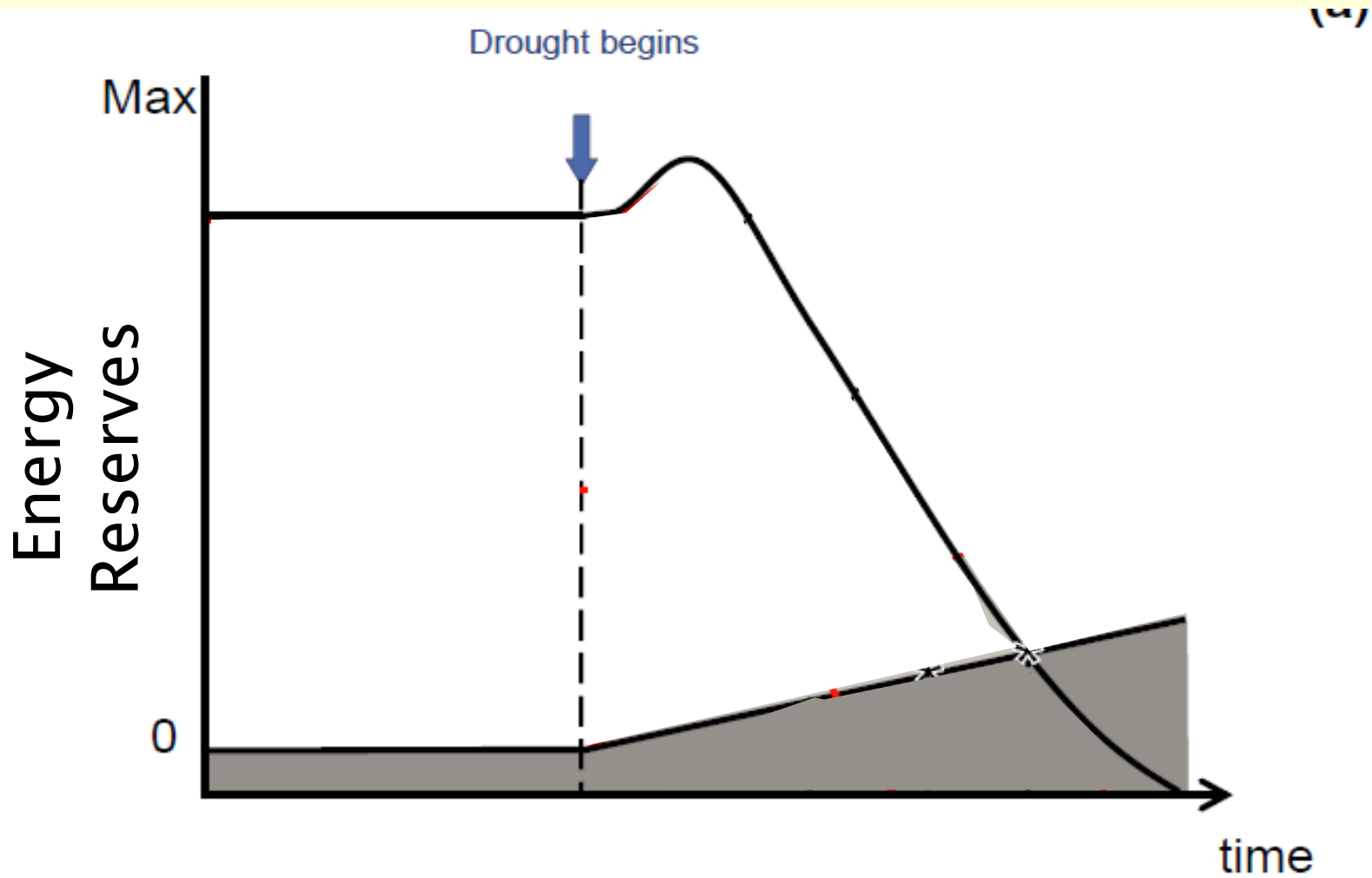
Trees and drought: problematic in several ways...

- ~ Trees need water to “feed themselves” (photosynthesis)
- ~ Drought = reduction in growth (which may persist)

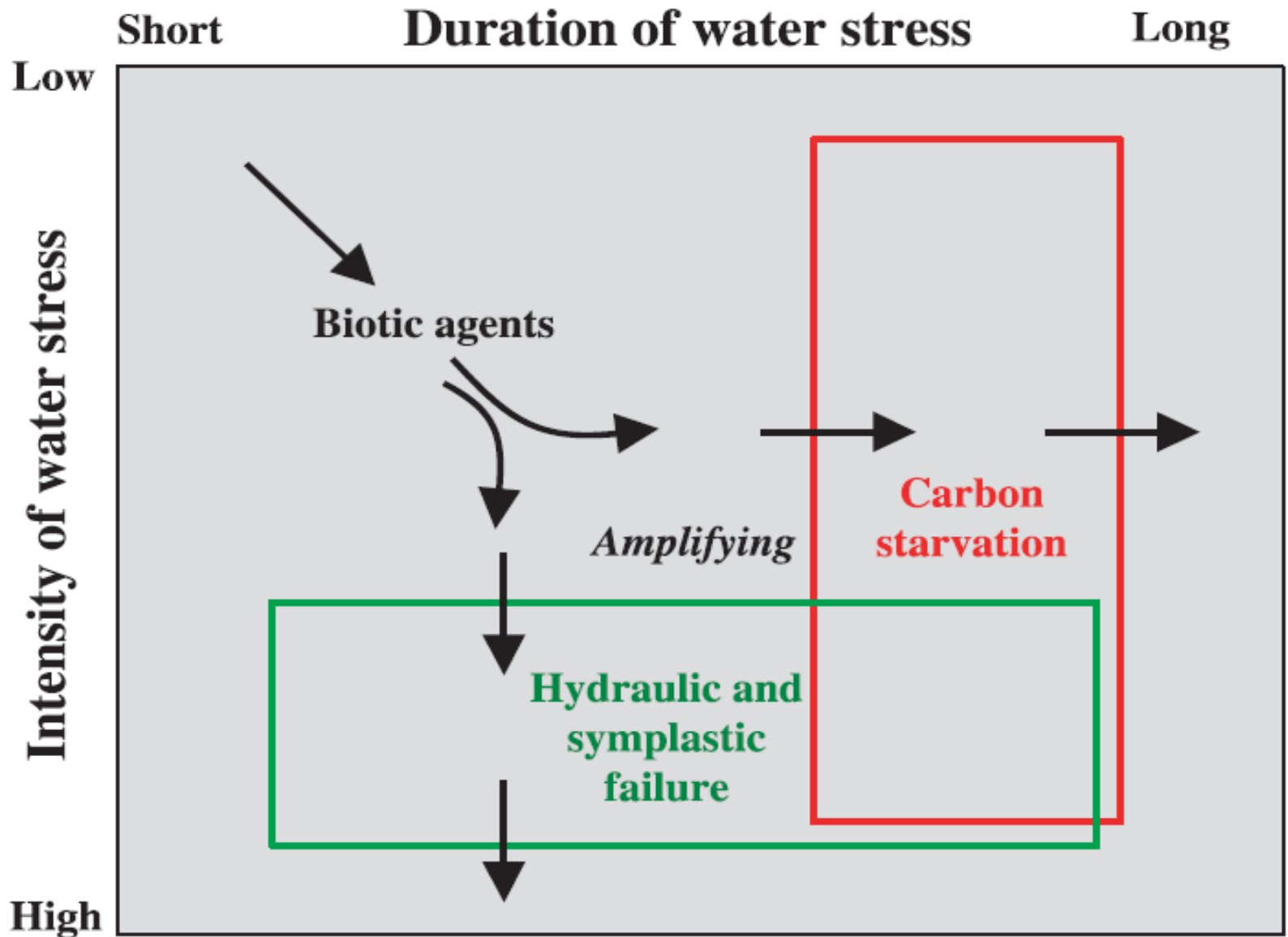


Watson and Himelick, 2013

Trees and drought: depleted energy reserves

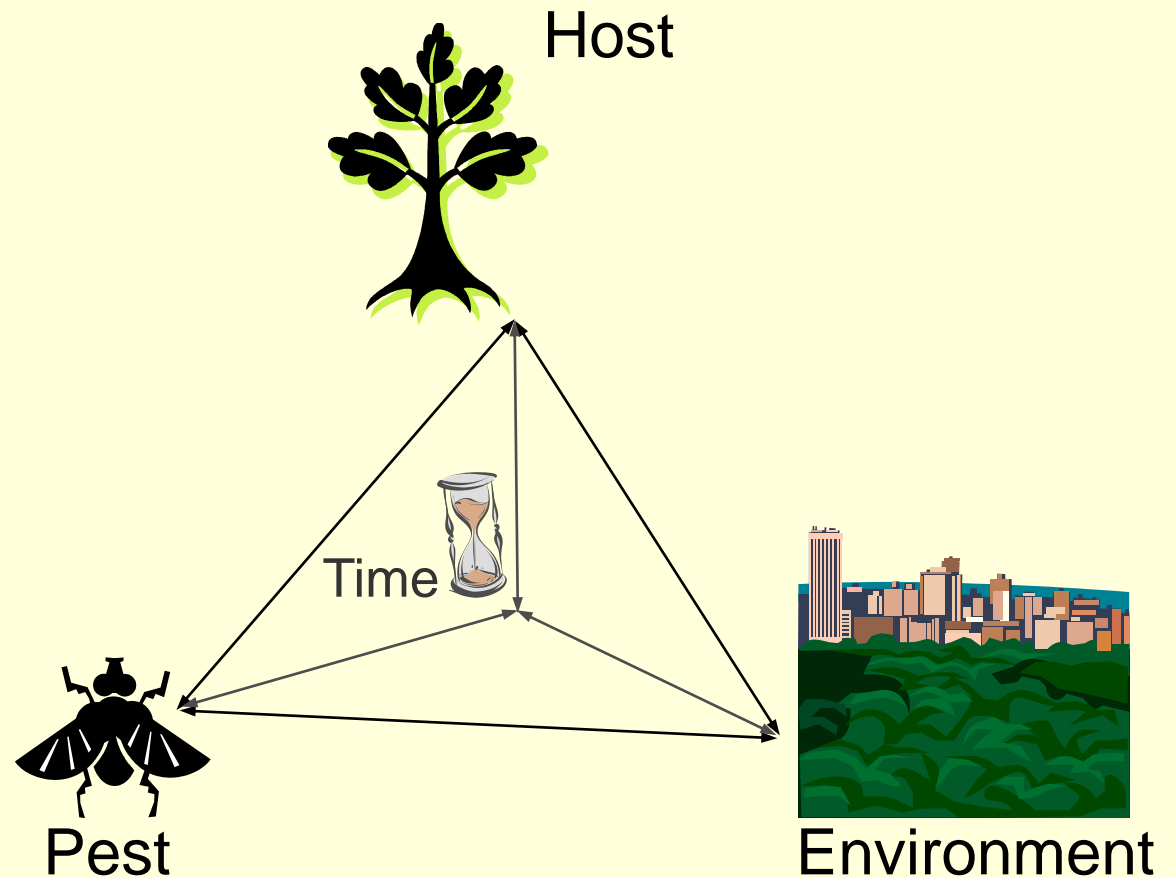
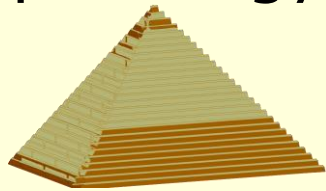


Recap: death from drought: embolism or starvation



four elements of a pest problem

Plant pathology



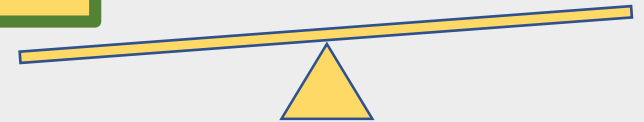
Drought and pests: Conceptual diagram

Drought characteristics:

Duration Severity Timing

Effect
on
Tree

Effect
on
Pest



Tree characteristics:

Drought tolerance
Predisposition

Pest strategy/"strength"

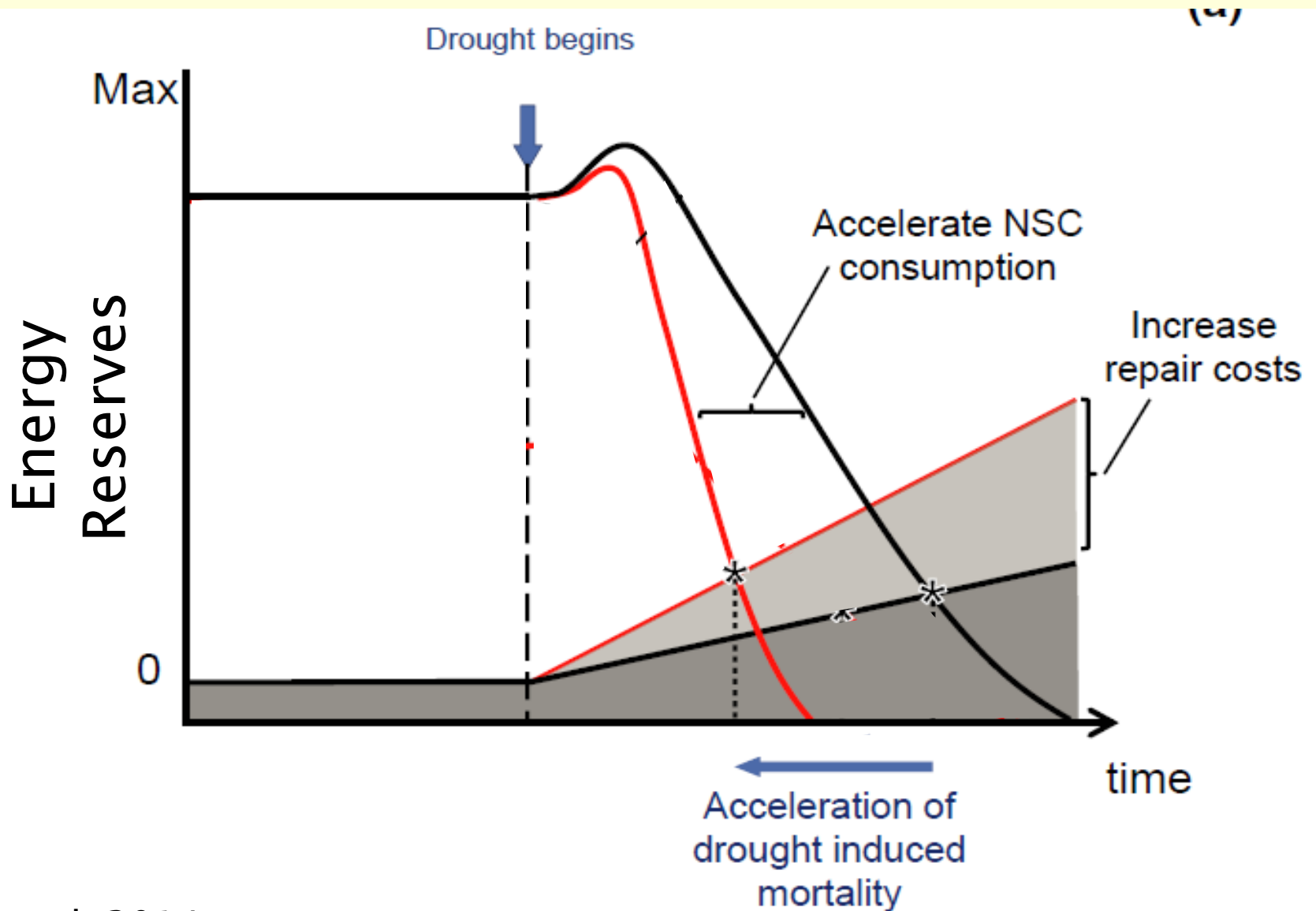
Primary vs Secondary

Pest lifestyle

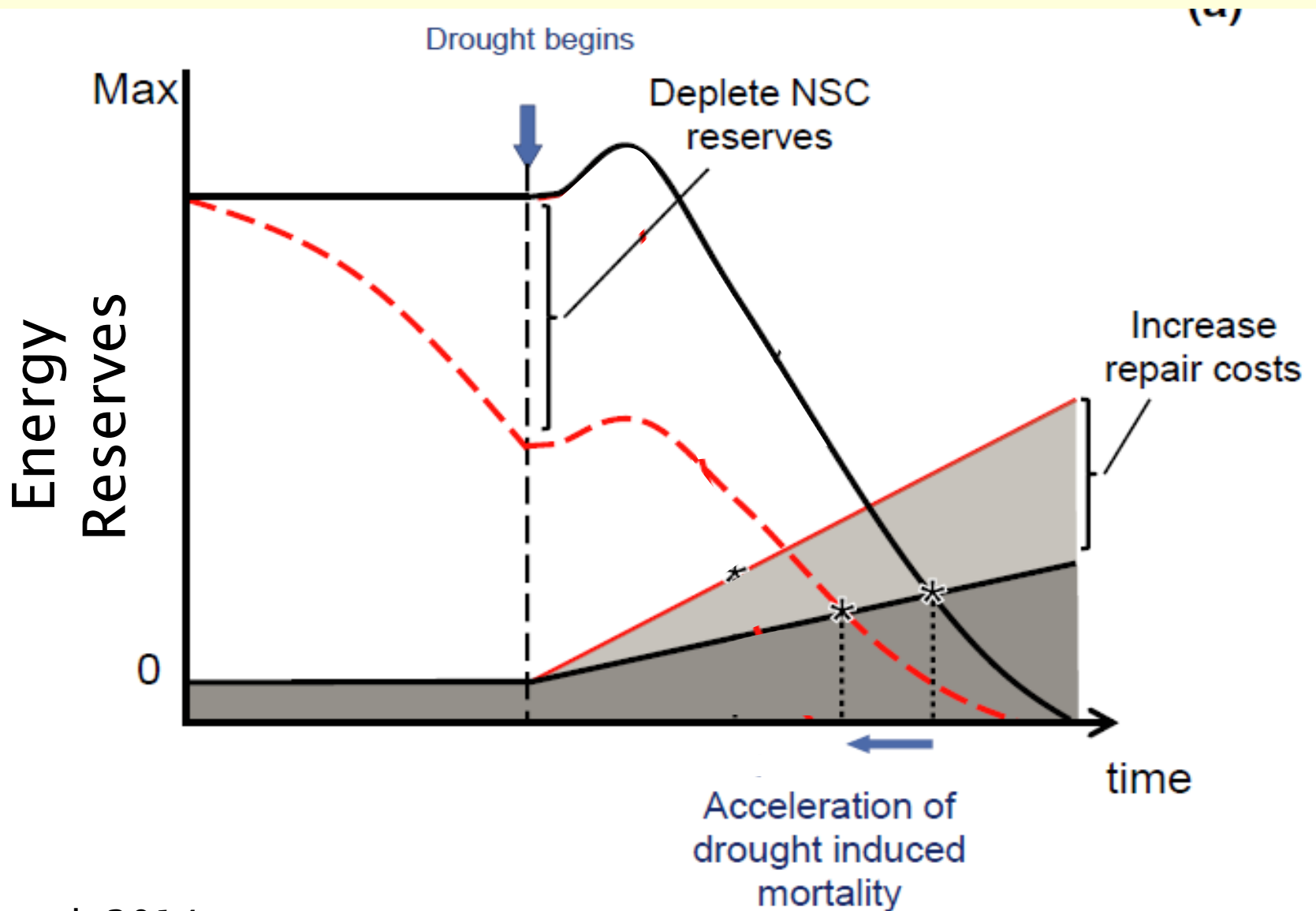
Insect: Where does it live, how does it feed?

Disease: a killer, parasite, or clogger?

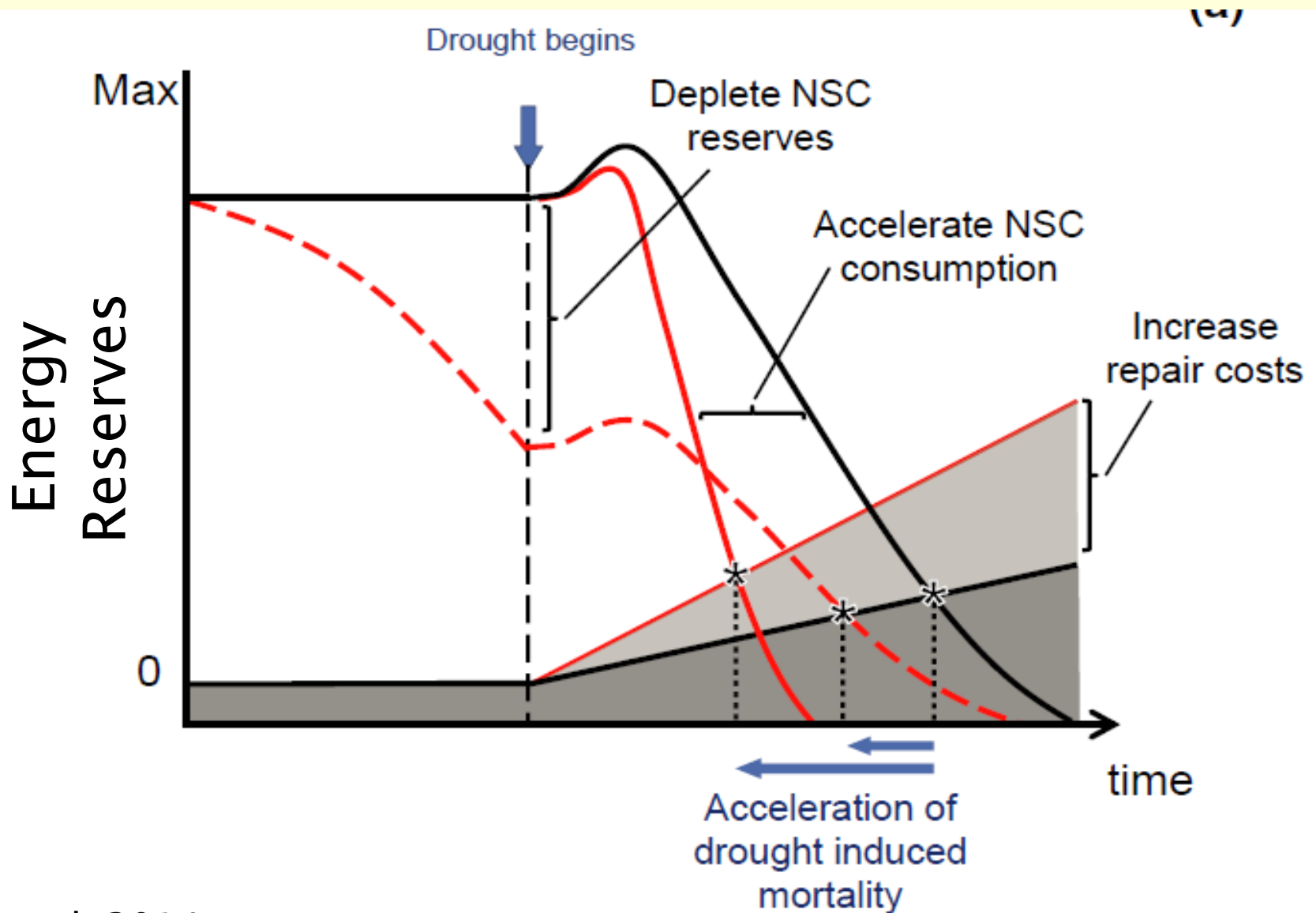
Trees and *drought* + **pest** at the same time



Trees and *pest* first, then drought



Timing of drought vs. pest infestation: important!



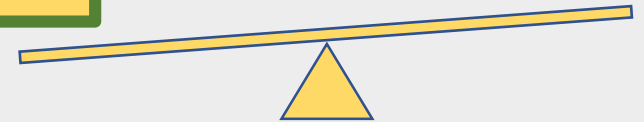
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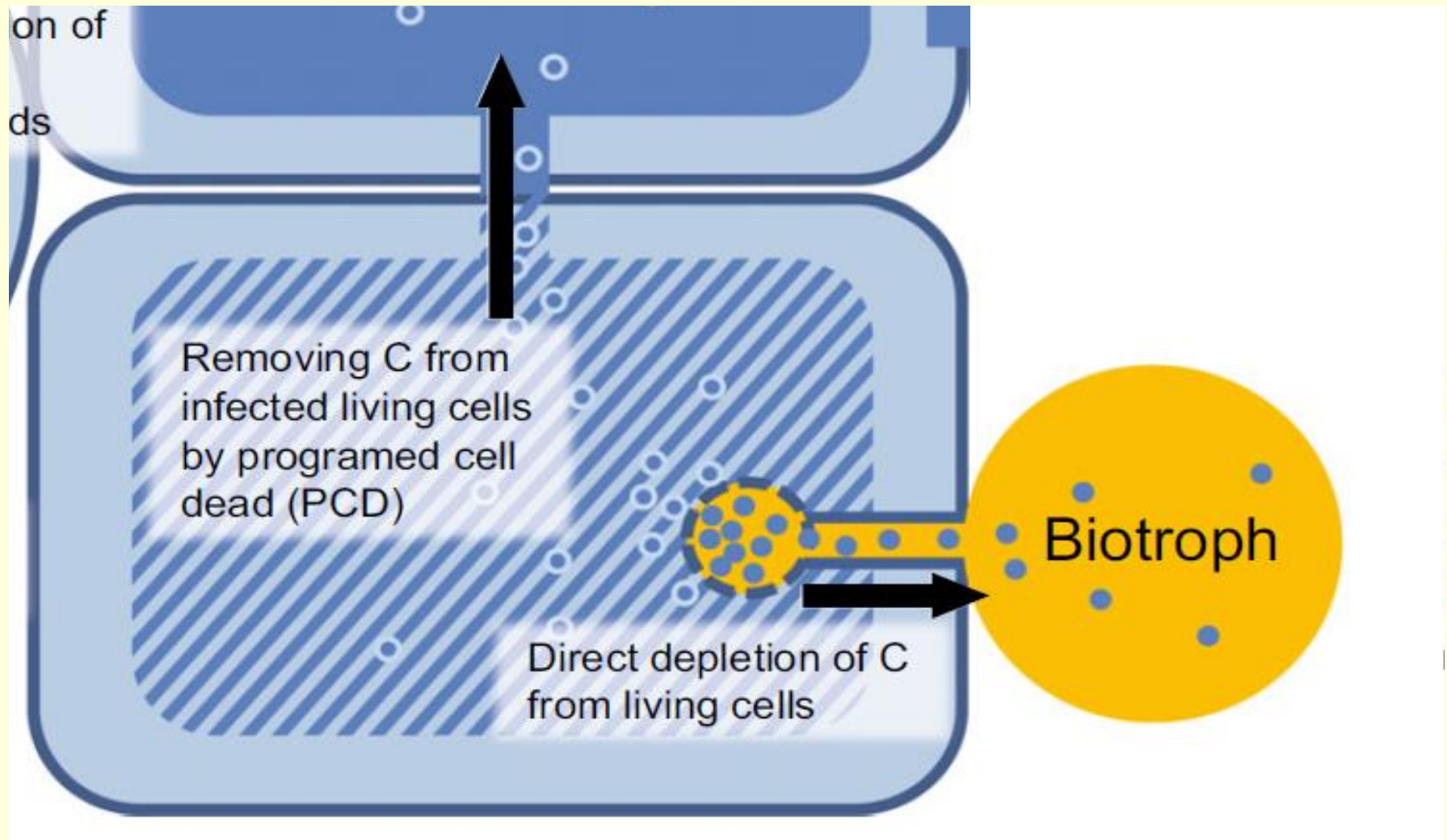
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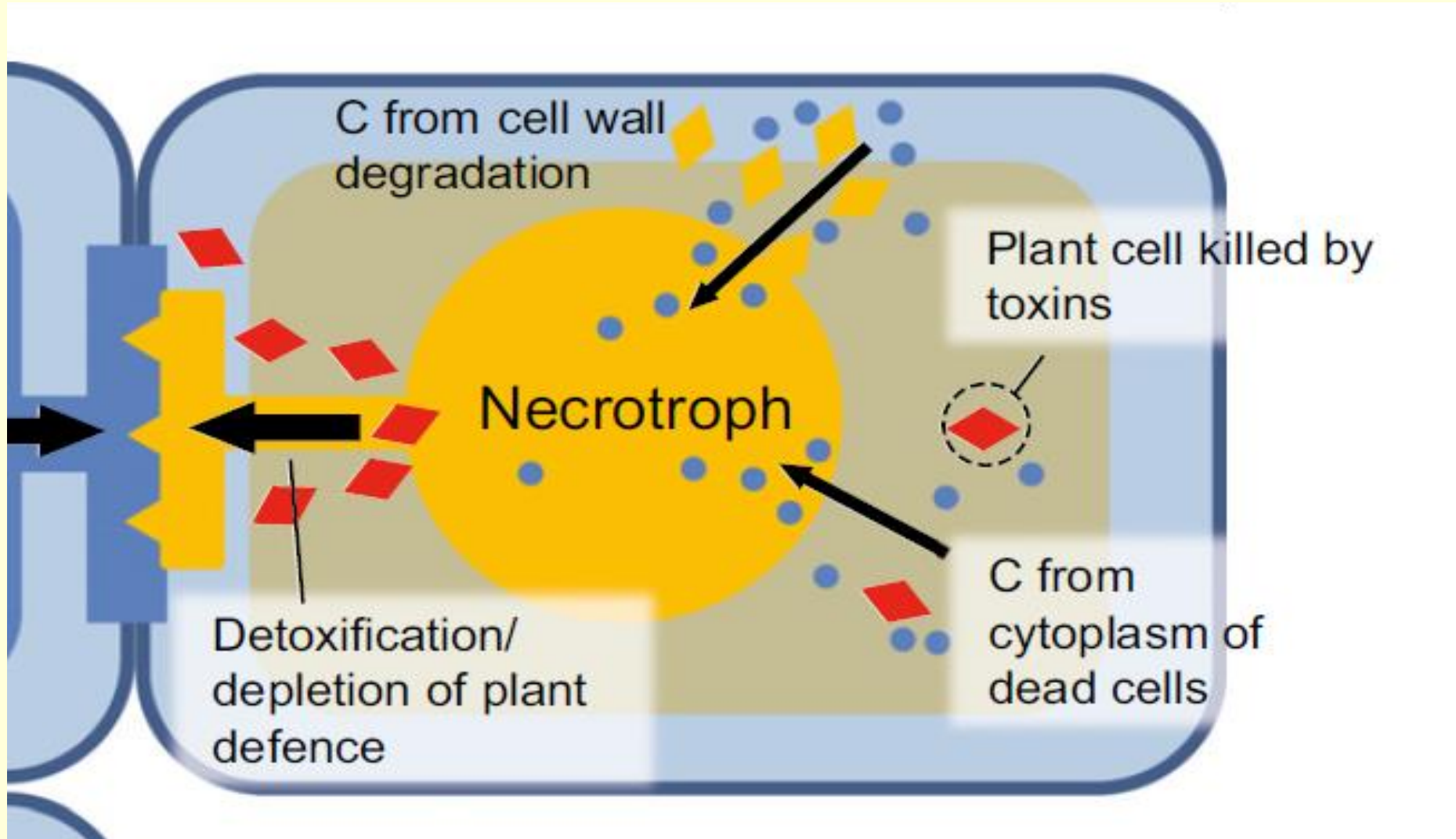
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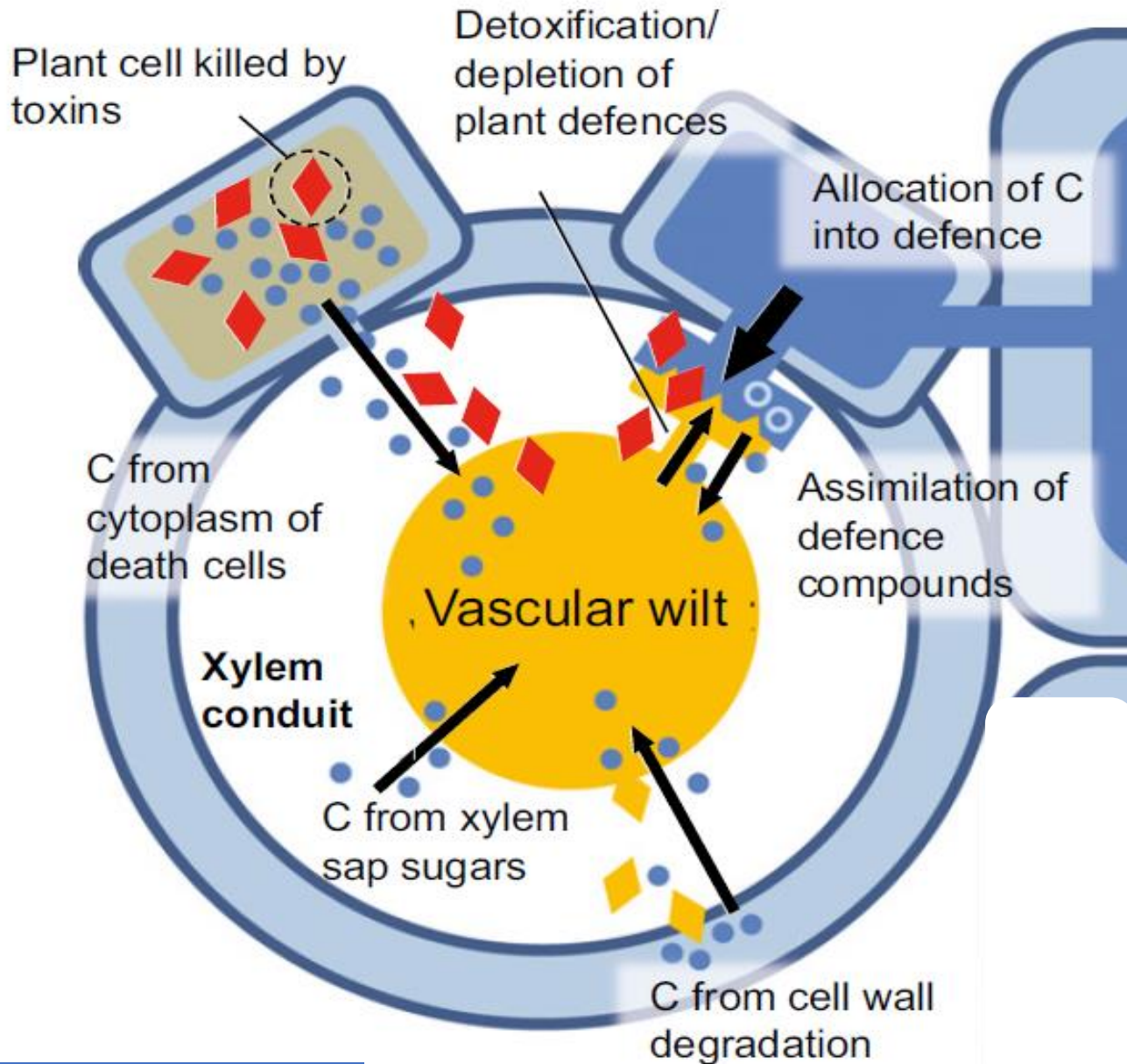
Pest lifestyles: parasites, killers, cloggers



Pest lifestyles: parasites, **killers**, cloggers



Pest lifestyles: parasites, killers, cloggers



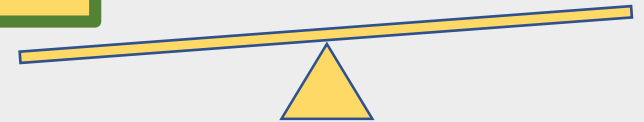
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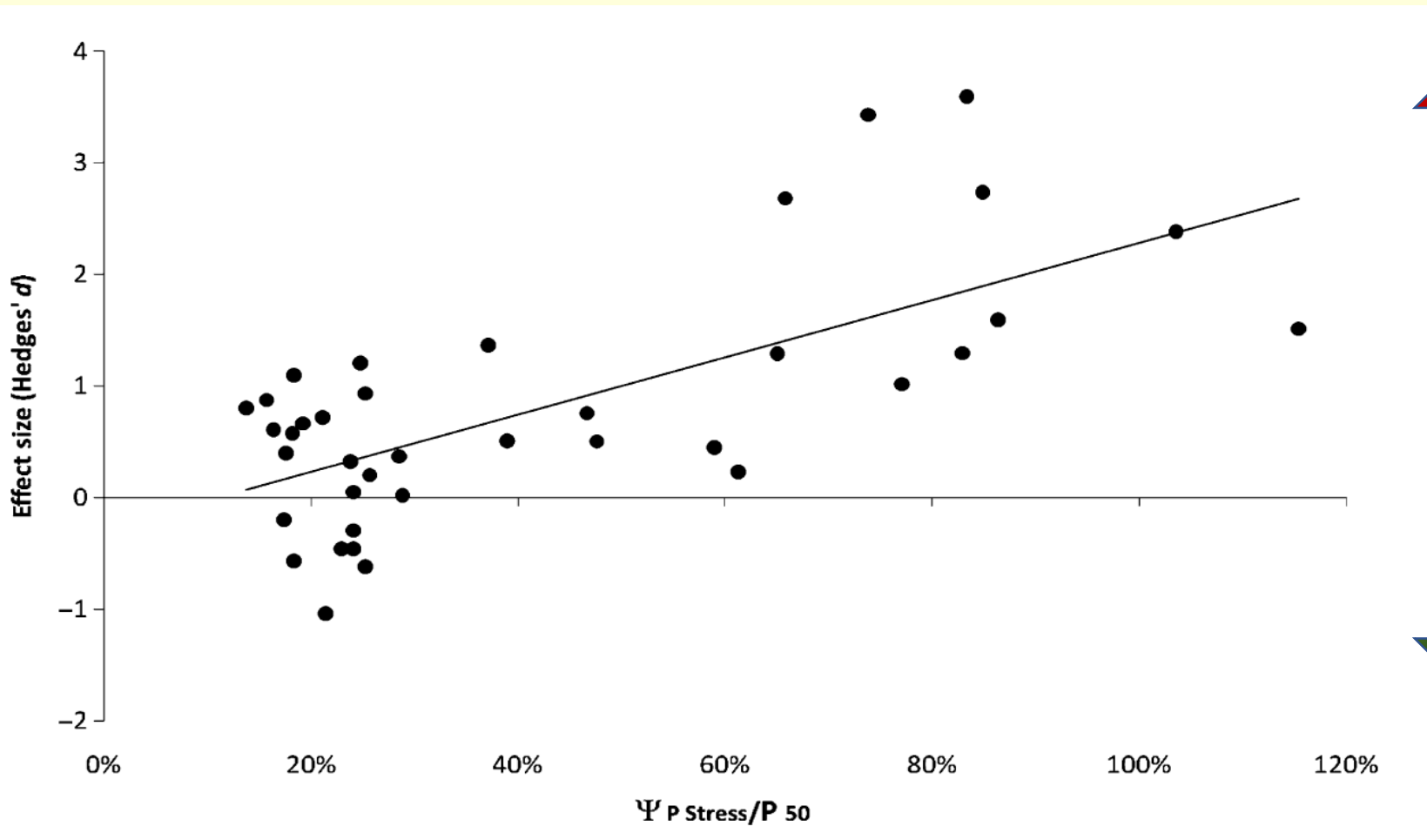
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Pests: Primary vs secondary, foliar vs. wood

Primary agent		Secondary agent	
Insect	Fungus	Insect	Fungus
Foliar organs <i>Asphondylia</i> spp. <i>Chrysomela populi</i> <i>Corytucha arcuata</i> <i>Elatobium abietinum</i> <i>Leaf aphid</i> sp. <i>Lymantria dispar</i> <i>Malacosoma disstria</i> <i>Neodiprion autumnalis</i> <i>Neodiprion fulviceps</i> <i>Neodiprion sertifer</i> <i>Schizolachnus pineti</i>		<i>Septoria musiva</i>	
Woody organs <i>Dioryctria sylvestrella</i> <i>Matsucoccus feytaudi</i> <i>Pissodes strobi</i> <i>Pissodes validirostris</i> <i>Rhyacionia buoliana</i>		<i>Armillaria ostoyae</i> <i>Phytophthora cinnamomi</i> <i>Fusarium solani</i> <i>Thyronectria austro-americana</i>	
		<i>Dendroctonus frontalis</i> <i>Ips acuminatus</i> <i>Oncideres cingulata</i> <i>Scolytus ventralis</i>	
		<i>Biscogniauxia mediterranea</i> <i>Botryosphaeria dothidea</i> <i>Botryosphaeria stevensii</i> <i>Cystospora chrysosperma</i> <i>Leptographium wingfieldii</i> <i>Leptographium yumanense</i> <i>Ophiostoma ips</i> <i>Ophiostoma polonicum</i> <i>Sphaeropsis sapinea</i>	

Secondary pests: they really win in severe drought



A little dry...

Totally parched

Pest “Lifestyle” and “strength” interact with drought!

	Mild water stress	Severe water stress
Primary agents		
Foliar organs	↘	↘
Woody organs	↗	↗
Secondary agents		
Woody organs	→	↗

↘ Reduced damage in water-stressed trees.

↗ Increased damage in water-stressed trees.

→ Unchanged damage in water-stressed trees.

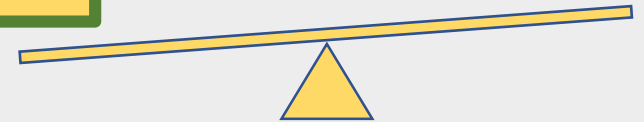
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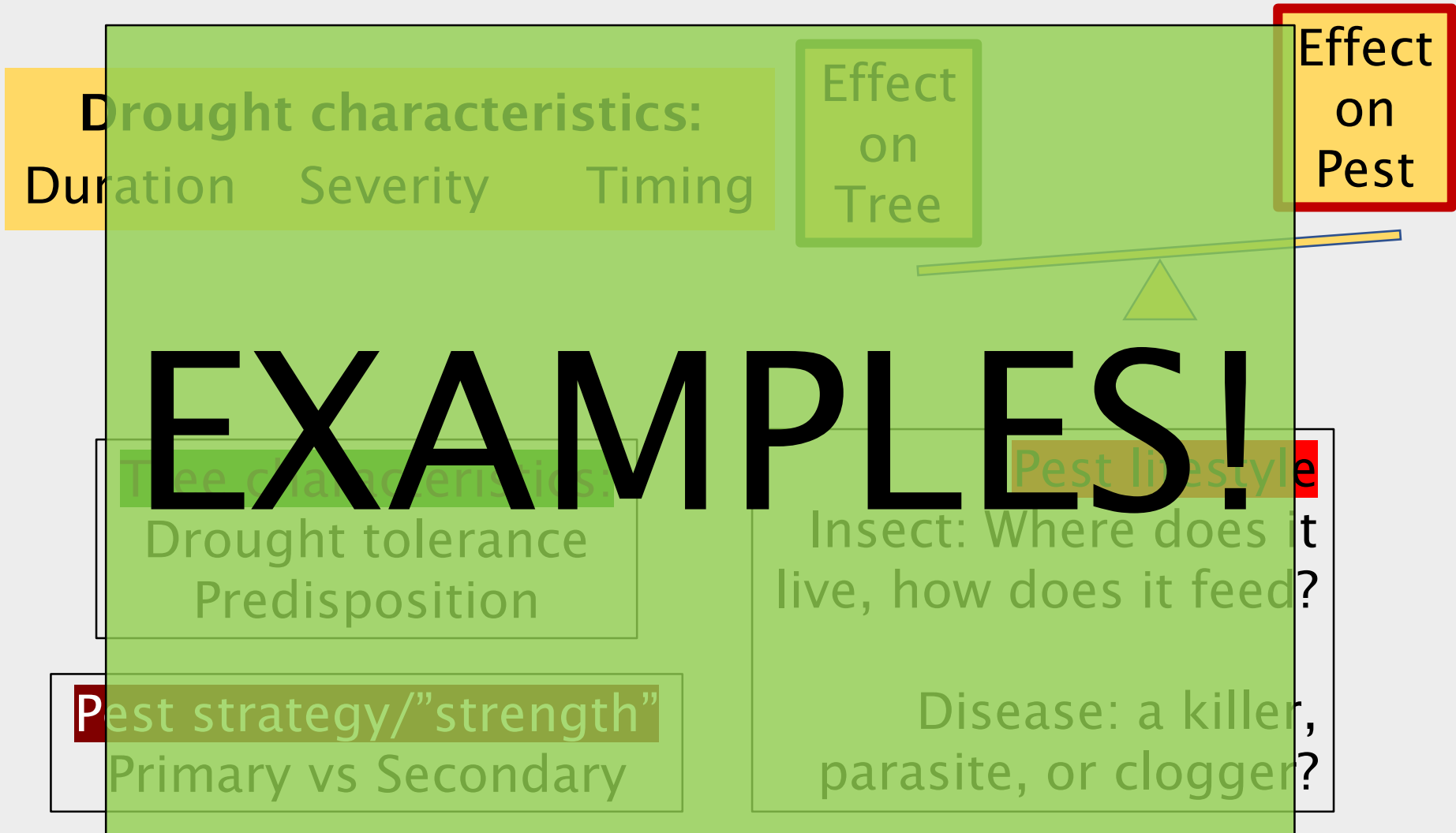
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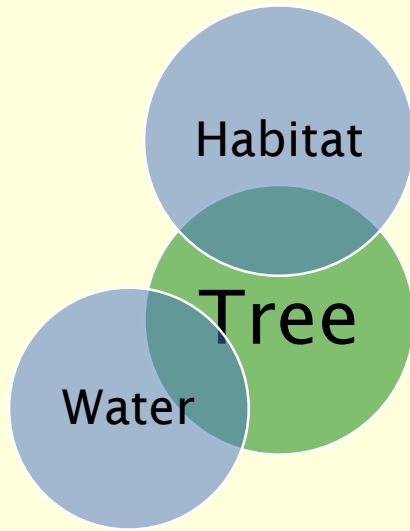
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Overview

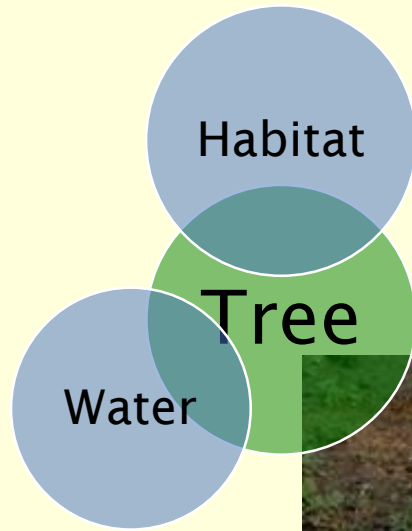


The interaction of drought
and pests... illustrated with
Old problems



New problems...

Armillaria as example old problems...



Oak root fungus

Poor cultural practices

Untreatable, lethal



Armillaria signs: mycelium



University of California



Armillaria signs: rhizomorphs



UC Statewide IPM Project
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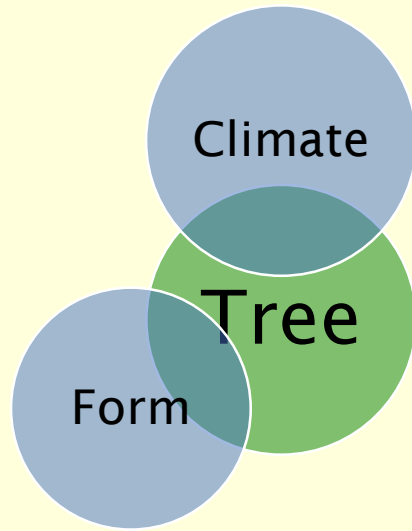
Photo: Eric Steinert, Munich.

Armillaria diagnosis and management

- Kendra Baumgartner found that root collar excavations in grape gave partial control of *Armillaria* in vineyards.



Another example of old problems



Powdery mildew on plane trees

Cultivars resistant (and not)





Sycamore/Planetree Powdery Mildew

Powdery mildews:

<> fungal disease

<> many pathogens,
even more hosts

<> Some are
host-specific

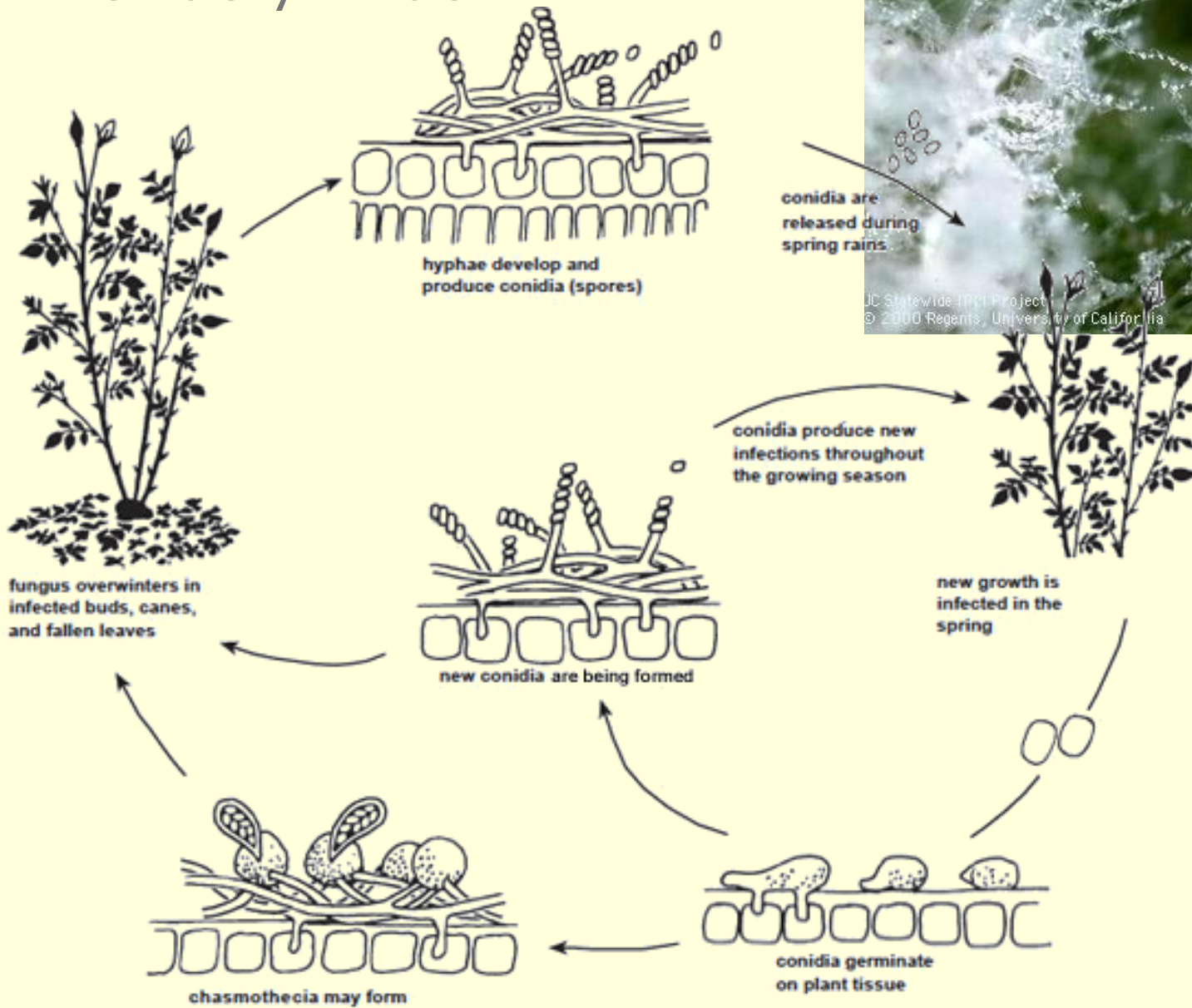
<> Like moisture, but not water

<> Like shade, humidity, density

<> For planetree: *Erysiphe platani* (= *Microsphaera* p.)



Powdery Mildew



Sycamore/Planetree Powdery Mildew

Management

- >> fungicides impractical (protectant, not curative)
- >> importance of sanitation: remove dropped leaves and other plant material
- >> can try improving airflow – but do not over-prune!
- >> Resistant cultivars are available – use them!
(Columbia; or Yarwood for pollarded trees)

Example of a
“clogger”

Dutch Elm Disease
(*Ophiostoma ulmi*)



Waukegan (Illinois, USA)



Insect Examples: Bark beetles and Ambrosia beetles



Combo example: Pitch canker

Individual infections, that
may progress down the
branches



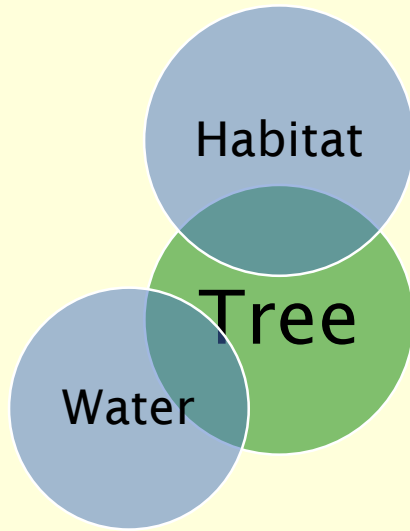
Pitch canker – *Fusarium circinatum* (“pine pitch canker”)

Host: Pines (but mostly
Monterey pine, *Pinus
radiata*)

Vector: several twig
beetles, engraver beetles,
and cone beetles



Overview



The interaction of drought
and pests... illustrated with
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New problems...

New problems: myrtle rust (a.k.a. guava rust)

Habitat

Tree

Water



myrtle rust

Puccinia psidii G. Winter

- ~ from Brazil!
- ~ FL 1977, HI 2005, CA 2006 (2011 on Melaleuca)
- ~ autoecious
- ~ likes it warm (>20C), humid (>80 RH); epidemics when nights 18-22C, 90% LW
- ~ deformed leaves, defoliation of branches, stunted growth, dieback, death.



myrtle rust

Puccinia psidii G. Winter

~ **damage:**

new tissues, tips
fruit, flowers, etc.

~ **spread:**

wind, vectors, plants, humans

~ 4-6 weeks before symptoms visible

~ **hosts:**

Myrtaceae: *Agonis*, *Eucalyptus*, *Eugenia*, *Melaleuca*,
Metrosideros, *Psidium*, *Syzygium*, etc.

~ likes it warm (>20C), humid (>80 RH); epidemics
when nights 18-22C, 90% LW



myrtle rust

CDFA says:

“a quickly spreading rust pathogen that is very difficult to eradicate due to its ease of long distance dispersal and broad host range”



So many pustules are produced that spores powder the hand

UFL says:

“~ Fungicide application is often not necessary as the disease is seasonal and quickly passes”

~ Limit periods of high relative humidity and leaf wetness through “proper” irrigation practices and plant spacing

~ Remove infected foliage

~ Spray as soon as the rust appears”

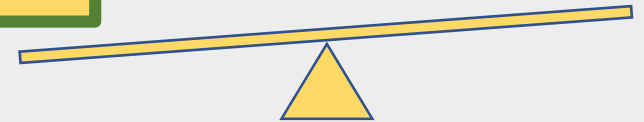
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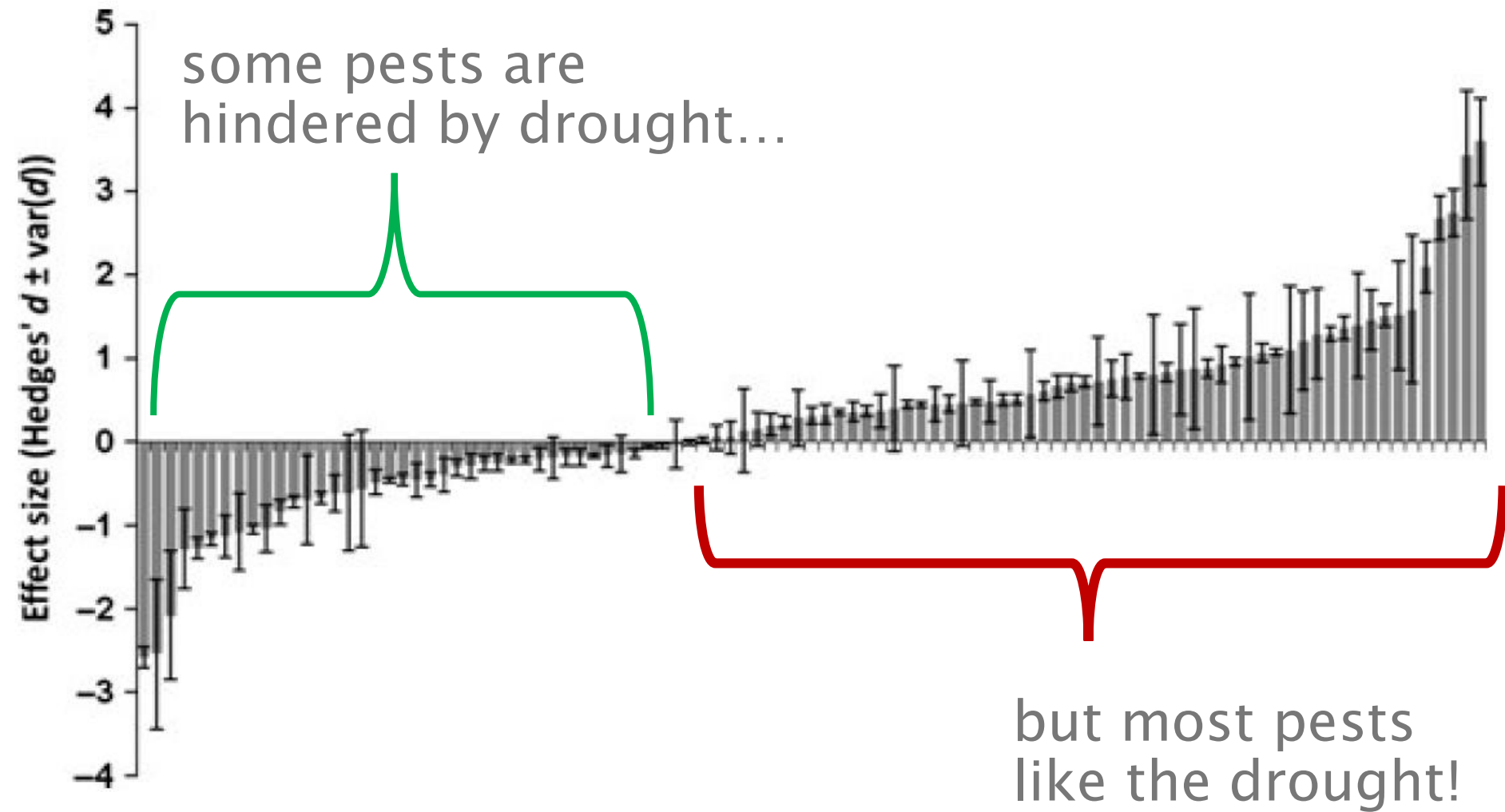
Primary vs Secondary

Pest lifestyle

Insect: Where does it live, how does it feed?

Disease: a killer, parasite, or clogger?

Overall pattern (from a “meta-analysis”):



...and so what...?

NOT a straightforward relationship...

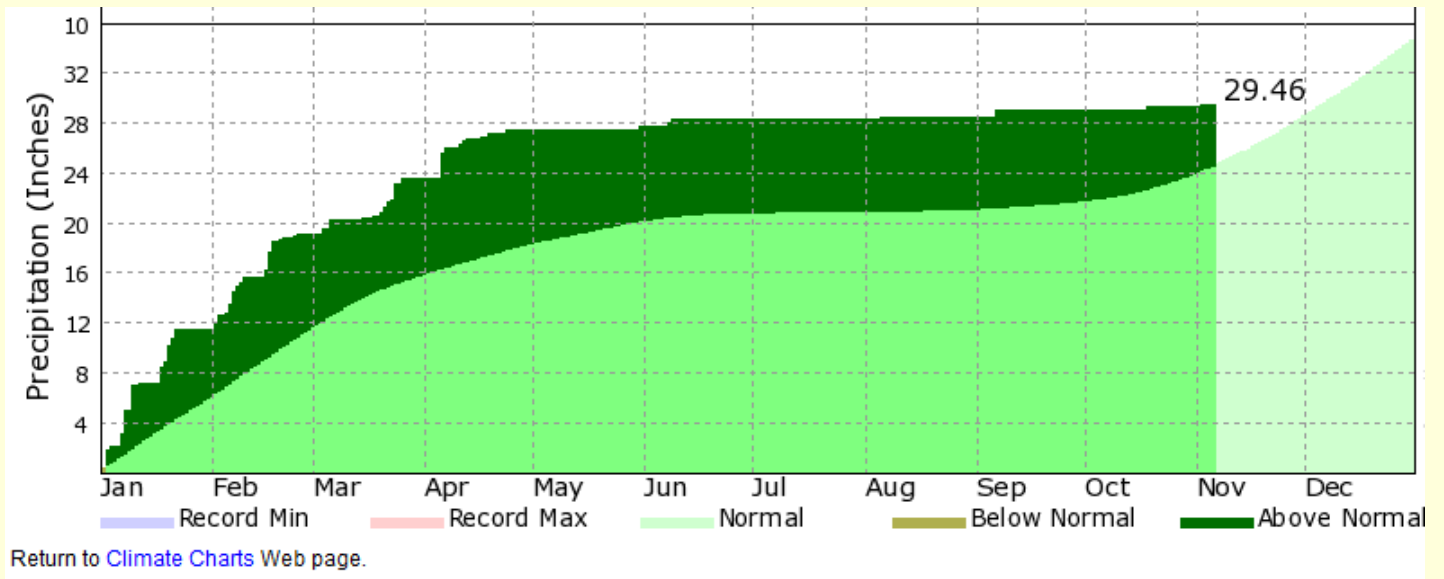
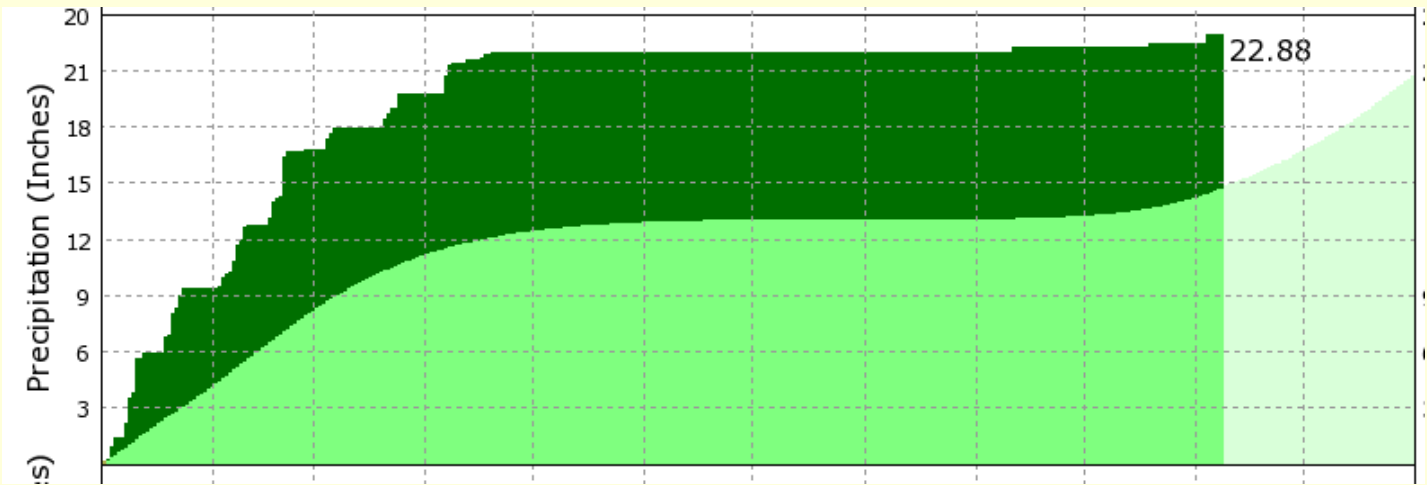
Things to know

→ The drought, its duration and severity

→ The tree, its history, prior condition, any management

→ The major pests, their lifestyle, “strength” and strategy

Check
your
local
rainfall...



Understand your tree's water situation...



Understand your tree's water preferences...

ucanr.edu/sites/Wucols

The screenshot shows a web browser window with the URL ucanr.edu/sites/WUCOLS/. The page features a prominent header with the text "WUCOLS IV" in large white letters on a dark blue background, and "Water Use Classification of Landscape Species" in smaller white letters on a red background below it. A navigation bar includes links for "SHARE", "EMAIL", "PRINT", and "SITE MAP", along with a search box labeled "Enter Search Terms".

On the left side, there is a vertical menu with the following items:

- Home Page
- User Manual
- Plant Search Instructions
- Plant Search Database
- Download WUCOLS IV Plant List
- Download WUCOLS IV User Manual
- Water Requirements for Turfgrasses
- Partners
- Acknowledgements

The main content area is titled "Home Page" and contains a dark blue box with the heading "GETTING STARTED". The text inside this box reads: "If you are using the WUCOLS list for the first time, it is essential that you read the *User Manual*. The manual contains very important information regarding the evaluation process, categories of water needs, plant types, and climatic regions. It is necessary to know this information to use WUCOLS evaluations and the plant search tool appropriately. To access the *User Manual*, click on the tab (on left) and view specific topics."

Below this box, the text continues: "Water conservation is an essential consideration in the design and management of California landscapes. Effective strategies that increase water use efficiency must be identified and implemented. One key strategy to increase efficiency is..."

To the right of this text is a photograph of a garden bed featuring various plants, including tall grasses and purple flowers.

Understand the main pests

ipm.ucdavis.edu

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

UC IPM

Statewide Integrated Pest Management Program

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*Solve your pest
problems with
UC's best science*

What's New

- Highlights:
[2014 Annual Report](#)
- Pest Notes: [Wild Pigs](#) added, [Flies](#) and [Skunks](#) revised
- Ag Pest Management: [Caneberries](#), [Artichoke](#) and [Avocado](#) updated
- Quick Tips: [12 English Quick Tips](#) and [BMSE Pest Alert](#) updated
- Green Bulletin: [May 2015](#)
- Online courses:
 - [Pesticide Resistance](#)
 - [Providing IPM Services in Schools and Child Care Settings](#)
- [More...](#)

QUICK LINKS

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[Recursos en español](#)

[Online training](#)

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Home, Garden, Turf & Landscape Pests



Agricultural Pests



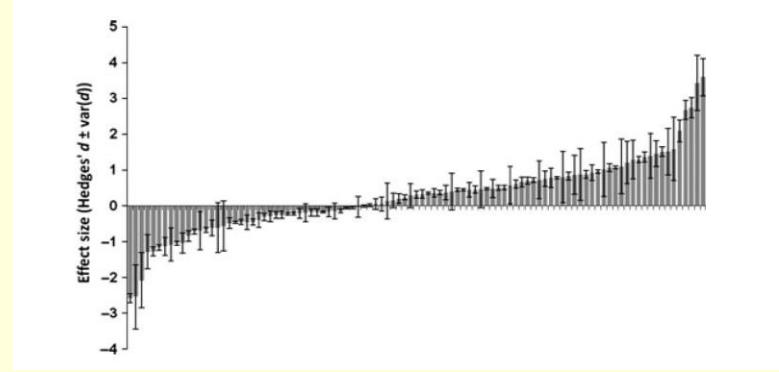
Natural Environment Pests



Exotic & Invasive Pests



main ideas



~ drought hurts trees, but it may hurt pests as well – the relative hurt matters

~ long severe droughts are always bad – but the effects may not show immediately

~ pest details (its “lifestyle”) and timing of infection matter a lot

When examining at a sick tree...

we are trying to determine THE EXTENT to which the drought contributed to the problem,

so that

we can choose the most appropriate management

Thank you!

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