

Integrated Pest Management



It's been around for a long time





“Forest pests can be managed by integrating all biological knowledge and applicable pest suppression technology into systems programmed by the ‘Man Agro-Delphi’ computer analysis approach; thereby implementing and enhancing the ability to live, on a permanent basis, within the agreed-upon foliage protection parameters. This approach, then, would become a workable Integrated Pest Management system.”

1990 USDA-defoliator protocol definition!



Textbook definition of IPM

“The selection, integration, and implementation of pest control based on predicted economic and sociological consequences.”



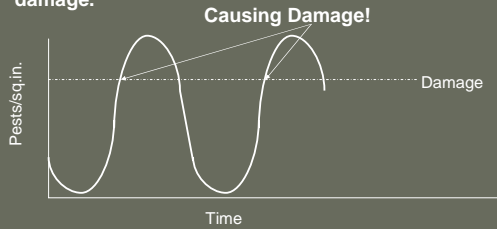
Regardless of the IPM definition, what it does have is Four Guidelines – Rules.



पिबन्ति नद्याः स्वयमेव नाम्नाः
स्वयं न खादन्ति फलानि वृक्षाः ॥
नादन्ति सम्यं खलु वारिवाहाः
परोपकाराय सतां विभूतयः ॥

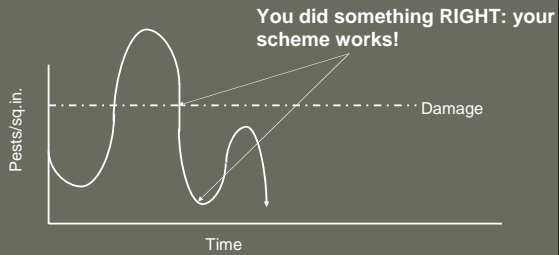
1st IPM Guide Lines

(1) Know the key pest well: it's biology, and natural controls. Also know when the key pest is causing economic, aesthetic, or sociologically important damage.



2nd IPM Guide Lines

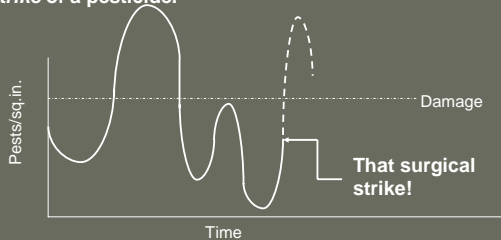
(2) Come up with schemes (management alternatives) to permanently lower the level of the pest population in its year-to-year fluctuations in numbers.



3rd IPM Guide Lines

(3) In spite of a great scheme to permanently lower the population of a key pest, the pest population grows anyway and threatens damage.

You must have ready with a well timed applied control technique – usually, the *surgical strike* of a pesticide.



4th IPM Guide Lines



(4) Monitor population levels of key pest. Monitor population levels of the natural controls (parasitoids and predators)

IPM Guide Lines

1. Key pests & their natural control?
2. What can you do to keep key pest populations down?
3. Do you have a remedial control?
4. Are you monitoring?



A case in point: IPM of the barkbeetle *Ips pini*



Ips pini attacks all species of pines across the pine stands of North America; this is its range in western U.S.



The life of *Ips pini* and why, from time to time, it causes problems.



OPENING STATEMENT: *I. pini*, like other pine-infesting Ips around the world are not aggressive, they are methodical, and have a well defined and sophisticated host selection behavior.

Ips live and breed in a temporary habitat

- Again, Ips normally find and breed in logging slash, windthrows, moribund trees (e.g. trees damaged by fire) etc.;
- When this kind of food material occurs, it's scattered all over the landscape, and;
- This food is drying out, or fermenting, or otherwise becoming unsuitable.

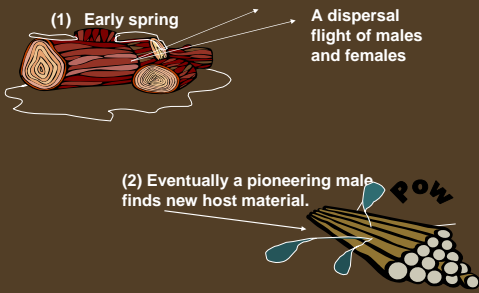
Thus, the main task of Ips populations is to quickly find and breed in this kind of host material. They have a tough task!



Ips pini flying in spring: a sophisticated opportunist

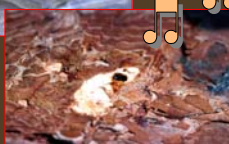


This is how *Ips* in general and *Ips pini* in particular find and colonize their temporary habitat.



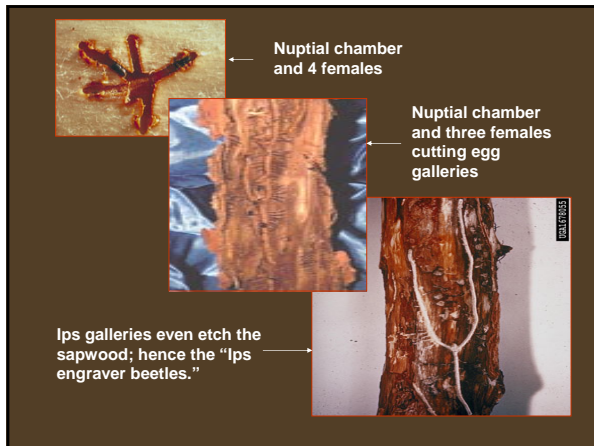


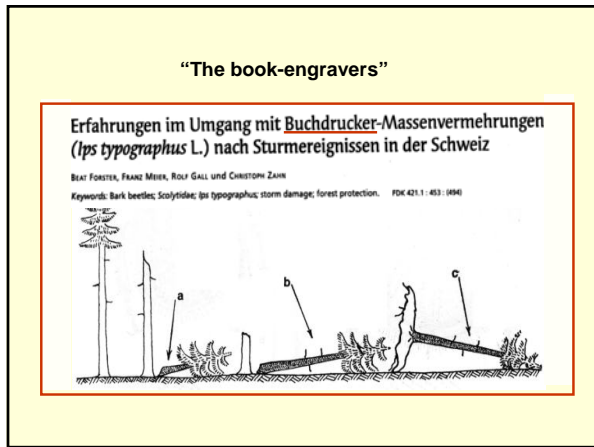
Pioneering male landing on log

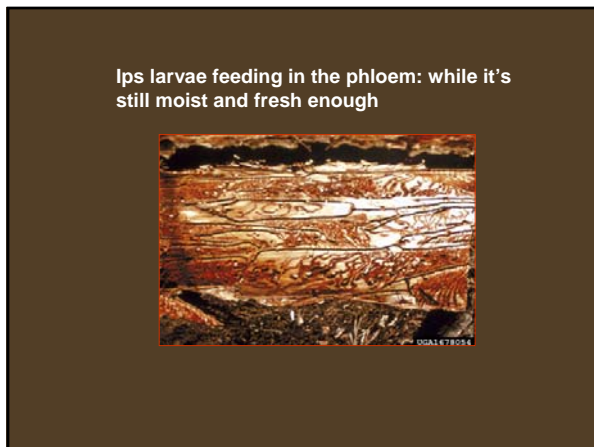


Male digging nuptial chamber

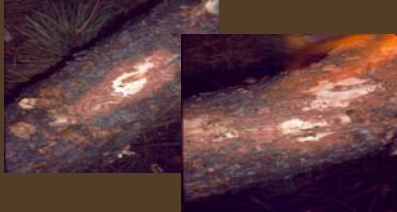
During nuptial chamber construction males produce an aggregating pheromone. *Ips* are polygamous and males persuade two or more females into nuptial chamber.



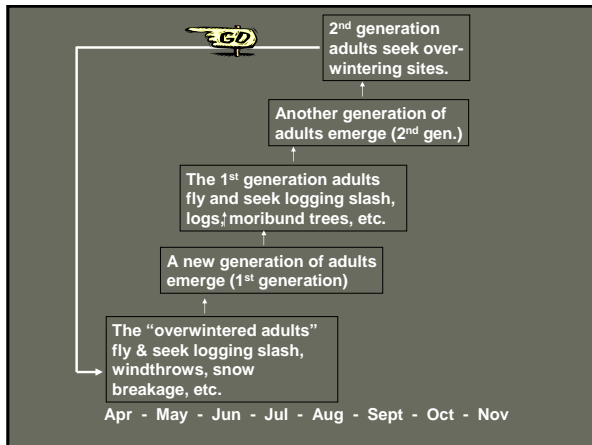


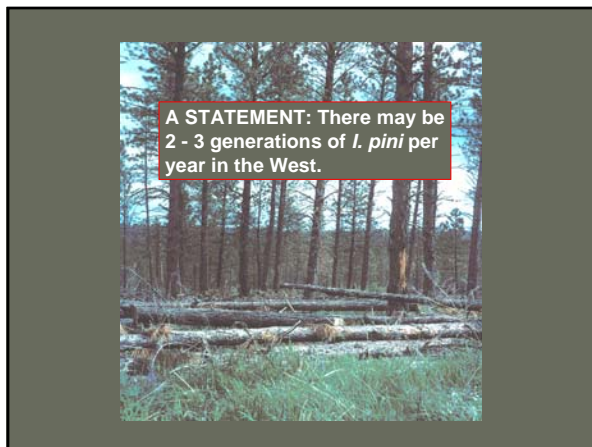


In the Intermountain West there are two generations/yr of *I. pini*. Most of the second generation overwinters in congregations under the bark of slash produced in late summer and fall. *It is this overwintering generation that flies in early spring.*



Masses of overwintering *I. pini* under bark of slash.





The Northern Cheyenne Tribe

- They logged all year -- had to support a tribal mill, a major revenue producer;
- Thinned their stands all year -- as the forest mgt. plan dictated, and they pruned their best stands.



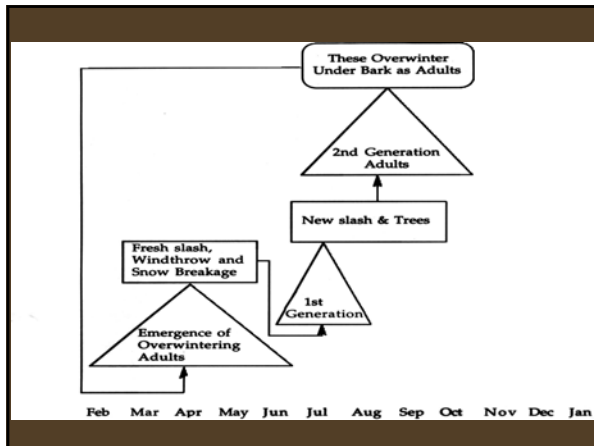
This is what happened:

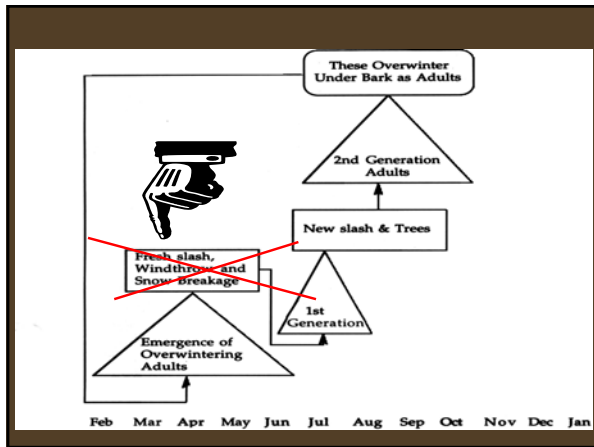
- continuous supply of slash was building up the Ips population, and
- a drought caused many pines to become susceptible to barkbeetle attack.
- Accordingly, there was a steady 2%-5% mortality rate of ponderosa pine: killed by *I. pini*.



The Question is: can an IPM plan be developed to stop mortality of living ponderosa pine?

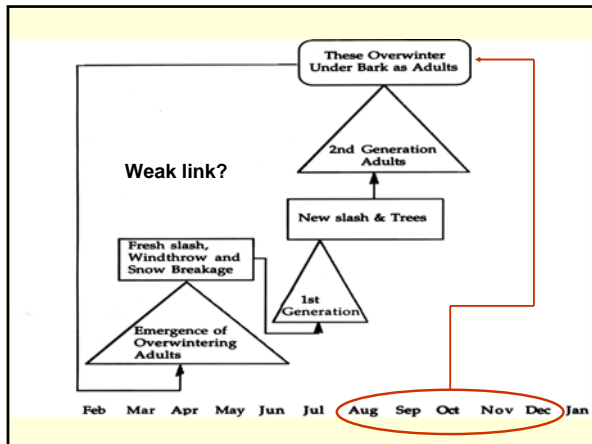
1. Economic Damage Level? -- stop 2% stand mortality.
2. Weak point that can be exploited? -- yes.
3. Are we ready with applied control if needed? -- yes.
4. Will we monitor populations of Ips and predators and parasitoids? -- yes.





(1) Recommendations to stop *I. pini* damage to living pine trees

- Create all the slash and log decks you want in late August - December.
- Logging then simply creates overwintering sites for Ips and doesn't increase their population.



(2) Recommendations to stop *I. pini* damage to living pine trees

- Slash must be minimized from January to April. If Ips have no fresh slash created in winter, they will not have a source of food material to colonize after they leave their overwintering sites.
- When winter logging is a must:
 - Pile and burn slash
 - Use a portable chipper

Winter logging: the slash must be chipped or piled and burned.



High volume portable chipper.



Commercial flame thrower for burning winter slash piles.

On the poorest sites, carry out stand improvement practices:

Thinning

Where feasible, bring back fire to thin the stands as well as remove late successional species



Practice forest sanitation: lop off the branches from logging slash, blow-downs, fire-killed residue and scatter this debris so that it dries out quickly.



After a series of drought-yrs and a buildup of Ips populations it may be necessary to treat slash and water-stressed trees with insecticides to prevent infestations in special use areas, e.g. campgrounds or trees in parks, housing developments etc.

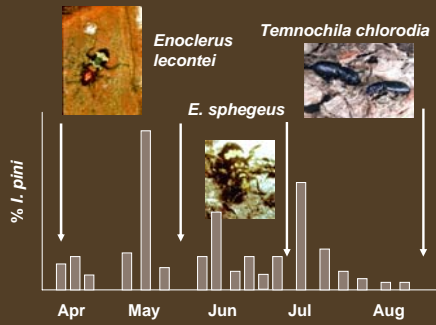


Monitoring Population Levels of Pest and its Natural Controls

Funnel traps baited with synthetic attractants of *I. pini*. These monitor population densities and flight periods of both Ips and its predators.



Three species of predators (attracted to the *I. pini* pheromone) bracketed the flight periods of *I. pini*



Monitoring population levels of *I. pini* generated by pieces of slash: estimated by developing an Index of Population Change (IPC).

- IPC =1.0: Population unchanged
- IPC >1.0: Population increased
- IPC <1.0: Population diminished



IPM Review

1. Key pest is *Ips pini* & objective is to prevent killing of standing trees, < 2%;
2. Management tactic to lower the GEP of the Ips population:
 - log most heavily in fall and through December
 - pile and dispose of slash created during winter
 - pile and burn
 - chip and mulch
 - in general de-emphasize winter logging
 - practice site sanitation e.g. lop and scatter slash
3. Have ready pesticides for emergency use only;
4. Monitor Ips and predator populations.
