Section 16: Legislation and Regulation

• Legislation and regulation play a significant role in insect management, often by preventing entry of exotic pests, but also in modifying crop production practices, the insecticides used, and genetically modified crops grown.

• This is an extremely important but oft overlooked part of pest management. Legislation, wisely used, sometimes can prevent problems from ever developing.

The tomatoes at right were grown in Mexico but purchased in Florida. When breaking apart the tomato cluster, a white web was revealed. Inside the web is the pupal case of a moth. The moth had emerged. Where is the moth?

This is not a trick question! It represents the problem with national and international transport of items. Insects hitchhike and establish in new locations. Regulations are designed to prevent this from happening, or at least minimizing it.

Exclusion

• Excluding entry of pests (e.g., the tomato example just mentioned) is one of the most common types of regulations affecting pest management.

• Legal basis for such exclusion usually rests with national governments, but sometimes states or other governments establish legislation designed to protect their environment or industries. In the USA, California is the most aggressive, but Arizona and Florida have strong programs, and other states act as needed.
Legal basis for exclusion

• In the USA, the Animal and Plant Health and Inspection Service (APHIS) is the principal federal agency involved in legislative matters, and at the local level the state departments of agriculture (or equivalent) play a role.
• The legal basis for such agencies to act is the Plant Quarantine Act of 1912, the Federal Plant Pest Act of 1957, the Noxious Weed Act of 1973, and others, including the International Plant Protection Convention of 1951, which is enforced by the United Nation’s FAO.
• Recent free trade agreements (e.g., GATT, NAFTA) contain elaborate sanitary (human and animal health) and phytosanitary (plant health) measures (referred to as SPS agreements).

• Effective regulation depends on good knowledge of biology and geographical distribution of pests, and an ability to detect and accurately detect pests in commerce.
  – When a cargo plane entirely full of cut flowers arrives at the Miami airport from Colombia in the middle of the night, what is the likelihood of detecting thrips in the blossoms, or in being able to identify any thrips as threatening to the USA?
  – What is the likelihood of detecting insects on military equipment such as army tanks when they are move to the USA after use overseas?
  – What is the likelihood of mosquitoes being detected in entire shiploads of used tires shipped from Asia to the USA for recycling?

These are some of the challenges facing regulators: personnel charged with enforcing legislation.

Asian tiger mosquito, Aedes albopictus, an example of an insect that escaped regulations designed to prevent entry of exotic insects. Until its discovery in Houston, Texas, in August 1985, this species was unknown in the New World. It is believed to be established in 866 counties in 26 states in the continental U.S. (map above reflects 2000). It has since spread to the Caribbean and South America. It reportedly was introduced with tires. Aedes albopictus is a maintenance (occasionally epidemic) vector of dengue viruses. Since the discovery of Ae. albopictus in the United States, five arboviruses (eastern equine encephalomyelitis, keystone, Tensaw, Cache Valley, and Potosi) have been isolated from this mosquito.
Routes of entry

- Routes of entry include natural and human-assisted means, such as:
  - Natural flight, which may be assisted by wind currents and storms
  - Baggage of travelers, which may contain infested items
  - Agricultural cargo or ballast
  - Cargo containers, wood pallets, and packing materials
  - Garbage
  - Smuggling

What to do?

- Because it is not possible to prohibit world trade due to the possibility that arthropods might hitchhike, several actions are taken:
  - Inspection is routine for items deemed likely to be transporting pests.
  - Monitoring is conducted around ports and airports.
  - Fumigation is used to protect against difficult to detect arthropods or, in some cases, if insects are found.
  - Eradication is implemented if exotic arthropods gain entry and establish, but have not dispersed widely.

### The top 10 quarantine pests in 125 countries

<table>
<thead>
<tr>
<th>Insect name</th>
<th>Number of countries citing</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Jose scale</td>
<td>44</td>
</tr>
<tr>
<td>Colorado potato beetle</td>
<td>40</td>
</tr>
<tr>
<td>Mediterranean fruit fly</td>
<td>39</td>
</tr>
<tr>
<td>Apple maggot</td>
<td>33</td>
</tr>
<tr>
<td>Oriental fruit fly</td>
<td>28</td>
</tr>
<tr>
<td>Japanese beetle</td>
<td>28</td>
</tr>
<tr>
<td>Boll weevil</td>
<td>21</td>
</tr>
<tr>
<td>Mexican fruit fly</td>
<td>20</td>
</tr>
<tr>
<td>Cherry maggot</td>
<td>20</td>
</tr>
<tr>
<td>Potato tuberworm</td>
<td>19</td>
</tr>
</tbody>
</table>
Inspection

- Phytosanitary certificates are issued by the quarantine service of the exporting country, and certify that commodities are free of quarantined pests, generally free of other pests, and also identify the crop and location of origin. All these items are important to importing nations. The quality of these efforts has improved in recent years with standardization of inspection protocols.
- Preclearance is also practiced in some cases. In this case, inspection occurs at the site of production/origin. It may involve inspection by the importing country, or simply mutually agreed-upon standards of inspection.

Questions

- How is pest occurrence used as a trade barrier?
- What agencies and acts exist to protect American agriculture from non-indigenous pests?
- Name 4 common route of entry by non-indigenous pests.
- What actions can be taken to limit insect invasion/importation?
- What is a phytosanitary certificate?

Treatment

- Many treatments prevent movement of insects. Cold storage, controlled atmosphere, and fumigation are examples of preventative treatments.
- However, many techniques can be used to prevent the crop from being infested, thereby eliminating the aforementioned treatments, or providing another layer of security. Examples include:
  - Washing with hot water
  - Washing with soapy water
  - Washing and brushing, or power-washing
Treatment of homes for termites often is legislated

- Chemical treatment of homes is often required by banks before they will lend money for home mortgages, and sometimes by state or local government.
- The process (method or chemical) of treatment may be legislated by a governmental agency to assure quality control.

Every homeowner’s nightmare: termites. The termites at right have been discovered and are in the process of walling off the opening. (photo, S. Gruner)

Risk assessment

- Risk analysis is a formalized process of identifying, assessing, and managing organisms that might be introduced with commodities.
- Former “zero-risk” policies were quite restrictive. Sought to avoid all risk.
- Now better knowledge that allows more accurate assessment and monitoring. Also more economic pressure to allow risk.
- International trade agreements (e.g., GAT, NAFTA) require consistent, open, documented, and science-based standards.

- Elements of risk assessment include
  - The probability of an unwanted, non-indigenous organism being moved,
  - The probability of a non-indigenous organism becoming established in a new area,
  - The status of the organism as a biotic pest.
- These 3 concepts should be framed in the context of international business, and not used as impediments to trade.
- However, even if extensive biological information exists, precise predictions are not possible.
Pesticide legislation

• In USA (sometimes elsewhere) all pesticides must be registered with the EPA.
• Label requirements include human and environmental toxicity, safety and handling instructions.
• EPA also grants exemptions.
• Registration is granted based on “reasonable certainty” of no harm to human and environmental health. Registration is crop-based (crop classes sometimes used) and regional.

Pesticide legislation

• Legal basis for pesticide-related regulations include
  – Federal food, drug and cosmetic act of 1938 (FFDCA)
  – Federal insecticide, fungicide, and rodenticide act of 1948 (FIFRA)
  – Food quality protection act of 1996 (FQPA)
  – Codex Committee of Pesticide Residues (CCPR)
  – Also, Endangered Species Act, Clean Air and Water Acts, etc.

Tolerances

• Tolerances are based on whether a pesticide causes a significant increase in tumors in animals. Negligible increase in cancer desired. Particular care given to foods heavily consumed by children.
• If tumors not induced, acceptable daily intake (ADI) is 1/100 highest dose at which no adverse human effects noted.
• Pesticide exposure based on summation of all sources. New registrations not granted if ADI exceeded.
Exemptions

• Exemptions given to biocontrol agents and pesticides regulated by other agencies, or if posing no risk to human health.
• State and federal agencies may be issued exemptions to deal with unexpected pest outbreaks, or if use will not pose risk. Not usually issued for pesticides with cancelled registrations. Limited time period.
• Experimental Use Permits (EUP) issued to enable testing.

Applicator and Worker Protection Standards

• EPA requires adherence to application standards to
  – Eliminate or reduce exposure to pesticides for 72 h post-application,
  – Mitigate exposures that do occur,
  – Provide information to applicators and workers about proper pesticide handling and the hazards of pesticides.

Pesticide Applicator Certification

• Pesticides classified by EPA as either general or restricted use. General pesticides, not restricted-use pesticides, are easily obtained.
• Restricted use (hazardous) pesticides can be used only by certified applicators, or laborers under the direct supervision of a certified applicator.
• Certified applicators classified as either private or commercial applicators. Commercial applicators receive compensation for their services.
• States impose regulations according to classifications.
Economic Effects of Pesticide Regulation

• Costs and benefits not really clear.
• General hypothesis is that (safety) regulations inhibit innovation because marginally profitable products become too costly to develop. Producers should favor broad-spectrum products if they bear high regulatory costs, because they can sell more product. May be incompatible with IPM.
• On the other hand, more testing ensures that products are more certain to be safe to humans, and possibly the environment.

• Minor crop registrations are affected by testing regulations. The toxicological and environmental tests require that there be substantial revenue from sale of pesticides, and minor crops may not generate such revenue. Some crops left without registered pesticides.
• High registration costs favor a smaller number of large pesticide companies, possibly reducing options.
• Producers in non-regulated countries are favored in the international marketplace.
• Non-chemical alternatives have substantially lower costs, favoring their development.

Number of new pesticide registrations by crop type

<table>
<thead>
<tr>
<th>Year</th>
<th>Major field</th>
<th>Minor field</th>
<th>Veg.</th>
<th>Fruit &amp; Nut</th>
<th>Nurs. &amp; other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early 1970s</td>
<td>45</td>
<td>77</td>
<td>100</td>
<td>203</td>
<td>42</td>
</tr>
<tr>
<td>Late 1970s</td>
<td>19</td>
<td>30</td>
<td>103</td>
<td>114</td>
<td>40</td>
</tr>
<tr>
<td>Early 1980s</td>
<td>20</td>
<td>23</td>
<td>31</td>
<td>107</td>
<td>42</td>
</tr>
<tr>
<td>Late 1980s</td>
<td>22</td>
<td>22</td>
<td>8</td>
<td>50</td>
<td>23</td>
</tr>
</tbody>
</table>
Genetically Modified Organisms

- Opinion on the safety of genetically modified organisms (GMOs) is controversial and unsettled.
- Bt-based host plant resistance common in some crops, but direct ingestion of GMO crops prohibited in some areas.
- Exposure of nontarget organisms to GMO is of concern to conservationists.
- Movement of genes to wild plants has unknown effects.

More questions

- What treatments can be used to minimize transport of insects in commodities?
- What is “risk analysis” with respect to commodity importation?
- What is the safety basis for pesticide registration? What is ADI?
- Why are exemptions to registration issued?
- Distinguish between general and restricted use pesticides.
- How does pesticide regulation affect pesticide cost and availability?

Questions from supplementary reading

- Bt corn and parasitoids
  - How does European corn borer damage corn?
  - Why is Bt corn more attractive than insecticides to some corn producers.
  - Does Bt corn impart complete resistance to European corn borer?
  - Does Bt corn influence parasitism directly? Indirectly?