Biological Control Gone Bad! Story of the Cane Toad

Essential Question:
How can biological control methods have negative repercussions?

At a Glance:
Learners are introduced to the Cane toad—a biological control scheme that had very negative consequences.

Location: Outdoors or open indoor area

Objectives: *Learners will*
1) describe an example of biological control that did not work or had negative consequences.
2) brainstorm these negative consequences could be avoided.

Skills: questioning, critical thinking

Supplies:
- Cane Toad images
- Chalk/whiteboard or large piece of paper
- Chalk/markers

Subjects: science

Time: 20 minutes

Background Information:
See the activity, Weeds vs. Bugs, for detailed information on biological control.

Cane toads were introduced to Australia in 1935 as a biological control method against the Greyback cane beetle that was destroying sugar cane crops. The Cane toad is native to South and Central America and had been used successfully as a biological control agent against beetles in Hawaii. This method of pest management went horribly wrong in Australia, however.

The life history and ecology of the Cane toad was not fully considered before its introduction, nor was its interaction with the Greyback beetle it was introduced to control. First, sugar cane can reach 6 to 8 meters in height. The Greyback beetle usually feeds in the top of the sugar cane stalks. Cane toads cannot fly or climb, therefore could not reach the beetles. Another problem was the timing – the Greyback beetle tends to be out during the daytime and Cane toads feed at night. The two species are not seasonally compatible either, so are not in the same place at the same time of year. The Australian sugar cane fields are much dryer than those of the Cane toads' native habitat and Hawaii. The toads need wet conditions to survive, so quickly moved from the sugar cane fields to moister areas. Its range has expanded southward, through Australia with no outlook of control.

Why is the Cane toad able to spread so easily? Though they need moist conditions, they can live in a variety of habitats. They will eat just about anything that they can fit in their mouths. This includes small lizards, snakes, frogs, tadpoles, marsupials, mice, snails, and terrestrial and aquatic insects, and even pet food and human food items left outside. The Cane toad eats many native animals and often out-competes native species for food and breeding sites. Their breeding habits also contribute to their successfulness in being so invasive. Cane toads can breed year round and lay 8,000-30,000 eggs at a time (sometimes twice a year). Australia's native frogs only lay 1,000-2,000 eggs per year, so cannot compete in numbers with the Cane toads' reproduction.

Another big issue with the Cane toad is that it is poisonous in all life stages. Adults have venom glands on their upper surface that exude toxic venom when the toad is provoked. Predators include birds, snakes, crocodiles, some mammals – even pets. Few predators in Australia have resistance to the Cane toad's venom; therefore die when they try to eat them. In turn, they are not successful predators or agents in reducing the Cane toad population.

There is some hope in sight, however. Meat ants, a native insect of Australia, have been found to kill smaller toads living around bodies of water. A parasitic Lung worm, native to South

America, also will kill the toads. Obviously, both of these options need to be researched heavily before initiating them as control. As of now, the main method for reducing populations of the toads is by euthanizing them manually (freezing, then disposing).

This story depicts a very drastic case of biological control gone bad. In other cases, even our beloved lady bug (lady bird beetle), have had mal-effects. The important lesson is to fully research both the problem species and control species to make sure that they are compatible. There also needs to be a natural predator of the introduced species so it does not get out of control, as with the Cane toad or the mongoose in other biological control cases. This method of management of invasive species is still a good one and a positive alternative to chemicals (herbicides, pesticides, etc). As in the case of purple loosestrife, there are success stories (see *Weeds vs. Bugs*). The key is research… and maybe a bit of luck!

Procedure:

1. Review the problems facing ecosystems when invasive species are introduced (loss of habitat, competition, endangerment, and extinction) and the use of biological control methods.
2. Tell learners the Story of the Cane toad in Australia. You may use the condensed/bulleted version and then add extra information from the Background section. Show pictures of the Cane toads and tell how they can grow up to 10" long and 4 lbs.
3. Ask learners what made this case of biological control turn out so bad. Write their answers on a chalk/marker board or large piece of paper.
4. If time permits, allow learners to develop a skit about the cane toad. For example, one child is a sugar cane stalk, holding their hands tall in the air. Another child is Cane toad trying to jump up to reach the beetles at the top of the sugar cane. Other roles may be native frogs, crocodiles, insects, pets, etc.
5. To conclude, ask learners to brainstorm how scientists can prevent this type of reoccurrence from happening.

Discussion:

What is biological control?
Why did the use of Cane toads as biological control not work?
How can scientists prevent negative occurrences of biological control? (study the life history of both the biological control and pest species to make sure they're compatible)

Story of the Cane Toad – Biological Control Gone BAD!

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The life history and ecology of the Cane toad was not fully considered before its introduction, nor was its interaction with the Greyback cane beetle.

- Sugar cane can reach 6 to 8 meters in height.
- Greyback beetles usually feed in the top of the sugar cane stalks. (toads can't fly or jump that high)
- Timing – the Greyback beetle tends to be out during the daytime and Cane toads feed at night.
- Not seasonally compatible, so are not in the same place at the same time of year.
- The Australian sugar cane fields are much dryer than those of the Cane toads' native habitat and Hawaii. The toads need wet conditions to survive, so quickly moved from the sugar cane fields to moister areas.

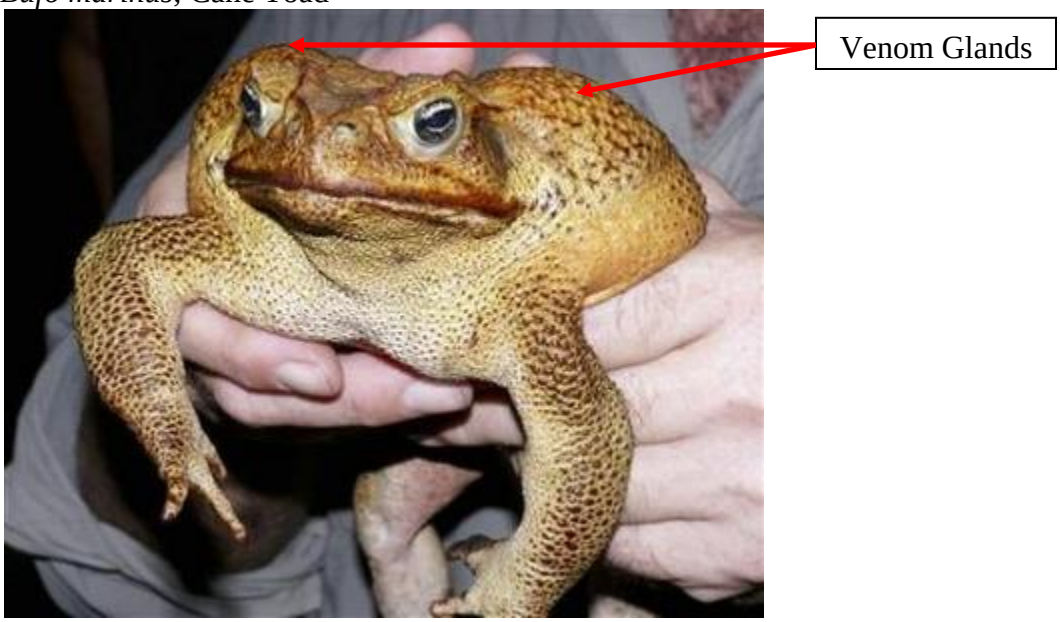
Why is the Cane toad able to spread so easily?

- Though they need moist conditions, they can live in a variety of habitats.
- Non-specific food preference: small lizards, snakes, frogs, tadpoles, marsupials, mice, snails, and terrestrial and aquatic insects, and even pet food and human food items left outside.
- Eats many native animals and often out-competes native species for food and breeding sites.
- Breed year-round and lay 8,000-30,000 eggs at a time (sometimes twice a year). Australia's native frogs only lay 1,000-2,000 eggs per year.
- Poisonous in all life stages. Adults have venom glands on their upper surface that exude toxic venom when the toad is provoked.
- Predators include birds, snakes, crocodiles, some mammals – even pets. Few predators in Australia have resistance to the Cane toad's venom; therefore die when they try to eat them.
- No successful predators or agents in reducing the Cane toad population.

There is some hope in sight, however.

- Meat ants, a native insect of Australia, have been found to kill smaller toads living around bodies of water.
- A parasitic Lung worm, native to South America, also will kill the toads.

Bufo marinus, Cane Toad



Freshwater crocodiles and other predators are killed by the Cane toad's toxic venom