# A Technology-Based Business Plan for Profitably Curbing Wildlife Trafficking


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# Biodiversity is Going Away

- The sixth mass extinction in the history of the planet is underway.
- Most large, wild mammals, many fish species, and many rare plants will be gone by 2060.
- Current conservation strategies are not working.

# Sharks and Elephants

- The great white shark, a particular species of fish is endangered.
- And the African savanna elephant was added to the IUCN Red List in 2021.

# And Cycads

For instance, the cycad plant, poached as a status symbol and investment, has been on this planet for about 280 million years. Dinosaurs didn't show up until 245 million years ago.

# Curbing These Human-Driven Extinctions

- The wholesale killing of animals and plants needs to stop, and habitat destruction needs to be curtailed.
- Recently, wildlife crime has become the most destructive force driving species extinctions – surpassing habitat destruction for the first time.

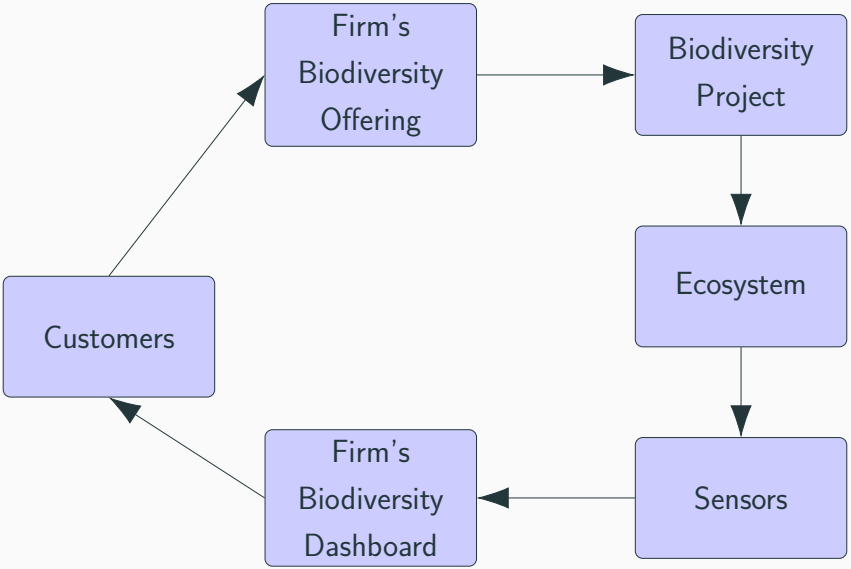
# Who is doing this killing?

- Any person engaged in the physical, acquisition of animal/plant parts for profit through the poaching (shooting, trapping, or poisoning) of live animals/plants is referred to here as a *poacher*.
- Poachers; poaching raid sponsors; and those who arrange shipments of poached animal/plant parts are *traffickers* who collectively, make up a *wildlife trafficking syndicate* (WTS).

# Private Enterprise to the Rescue

- Private, for-profit firms could save biodiversity by developing and running projects the conserve biodiversity. Indeed, private enterprise might be the last hope for many species.
- **HOW COULD THIS BE MADE TO WORK?** In short, by making biodiversity conservation **profitable**.

# Profitable Biodiversity Business Model



# Selling to Biodiversity-Concerned Customers

1. A firm identifies a species they want to save.
2. They launch a new product or service called a **biodiversity offering** that is attached through technology to a **biodiversity project**.
3. Using technology, this firm maintains a public-facing **biodiversity dashboard** that contains real-time, and audited information on the project and the species being saved.

# Technology #1: Marketing Analytics

**Identifying the niche market:**

Letting the time points be $t_1, \ldots, t_J$, the model is

$$SGR_{t_j,k,l,m,n,o} = \beta_0 + t_j\beta_{t_j} + \beta_{\text{gender}_k} + \beta_{\text{age}_l} + \beta_{\text{income}_m} + \beta_{\text{ownhome}_n} + \beta_{\text{education}_o} + Z_{t_j}$$

$$\text{where } Z_{t_j} = -\sum_{k=1}^{p} \phi_k Z_{t_{j-k}} + \epsilon_{t_j},$$

$$\text{and } SGR_{t_j,k,l,m,n,o} = \frac{ST_{t_j,k,l,m,n,o} - ST_{t_{j-1},k,l,m,n,o}}{t_j - t_{j-1}}.$$

# Computing Total Sales

The computed variable, $ST_{t_j,k,l,m,n,o}$ is total sales during time interval $\{t_{j-1},\ t_j\}$ across all customers who are in gender class $k$, age class $l$, income class $m$, ownhome class $n$, and education class $o$.

# Technology #1 Continued: What drives a repeat purchase?

Channel choice for making biodiversity offering purchase decisions through time is modeled with a multinomial, generalized logit, time series model:

$$\log\left[\frac{P(R_{i,t_i}=h)}{P(R_{i,t_i}=H)}\right] = \beta_{0,h} + t_i\beta_{t_i,h} + \beta_{\text{gender}_{i,h}} + \beta_{\text{age}_{i,h}} + \beta_{\text{income}_{i,h}} + \beta_{\text{ownhome}_{i,h}} + \beta_{\text{education}_{i,h}}.$$

# A SAS Code and Data Requirements

- The SAS code file, `channels.sas` fits this *autoregressive logistic regression* model to a test data set.
- Observations are needed on customers who have completed a biodiversity offering purchase. For each of these customers, observations are needed on the set of variables: $\{S_{i,t_i}$, $\text{channel}_{i,t_i}$, $\text{gender}_i$, $\text{age}_i$, $\text{income}_i$, $\text{ownhome}_i$, $\text{education}_i\}$.

# Example: An Insurance Company

- This firm designates and existing line of auto insurance policies to be heir biodiversity offering.
- Next, for their biodiversity project, they decide to participate in a *confederation* of wildlife crime investigators who are focused on tiger and tiger parts trafficking.

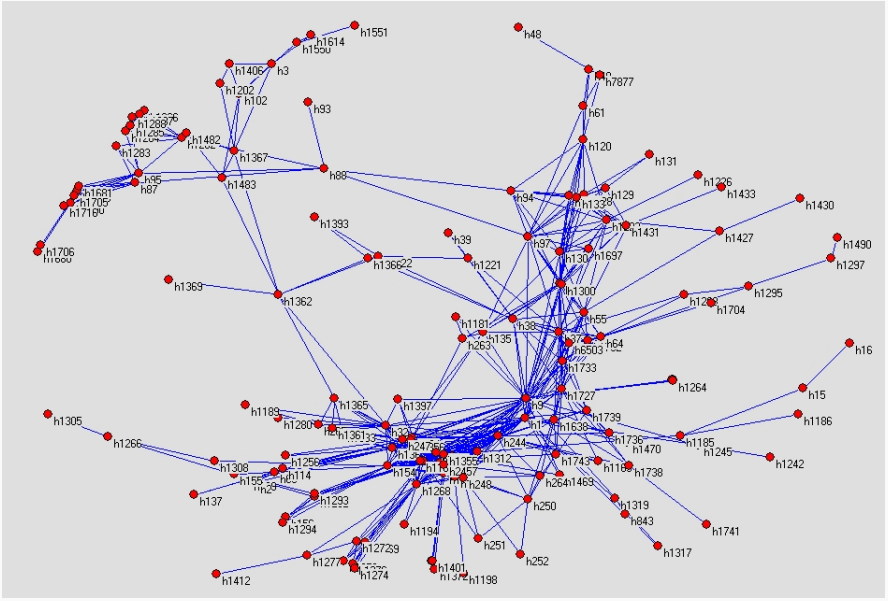
# Technology #2: A Confederation of Trafficker Investigators and Their Database

- A confederation is proposed of wildlife crime investigators who share a *trusted* criminal intelligence database.
- This confederation analyzes intelligence from cyber and non-cyber sources to produce and then deliver to law enforcement, recommendations for detaining, surveilling, and interdicting certain traffickers.

# Confederation Actions

- The confederation does this in two steps:
- **Step 1:** Compute an *actionable intelligence report*.
- **Step 2:** From this report, build the Detain, Surveil, and Interdict lists. Compute the syndicate's recovery time after those on the Detain list have been arrested.

# December 2014 South African Rhino WTS



# Confederation Deliverables

1. *Detain list*: A list of those WTS members (players) that law enforcement should detain for maximal disruption effect.
2. *Surveil list*: A list of those players that should be placed under surveillance for purposes of gathering evidence and/or information on future activities of the WTS.
3. *Interdict list:* A list of predicted WTS actions along with where and when these actions will take place. These actions should be interdicted.
4. *Recovery time:* An estimate of how long the WTS will take to recover from the removal of those players in the Detain list. Use this information to plan detention, surveillance, and interdiction operations.

# Technology #3: Protecting the Confederation's Database Against Insider Attacks

- Protecting a military/terrorism/criminal intelligence database against against *insider attacks* is an open problem.
- Three new algorithms will be implemented that will identify such interlopers.

# The Need for a Political-Ecological Simulator

- Identifies the most destructive trafficker
- Predicts political reactions to confederation actions

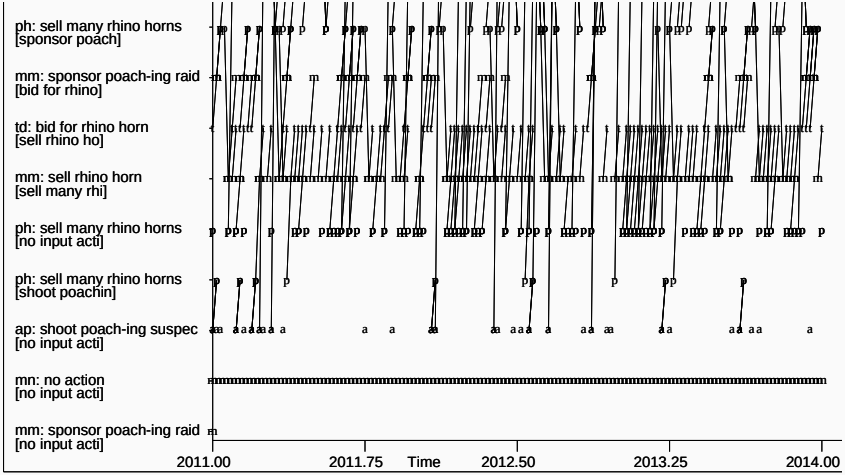
# Technology #4: Modeling the Political-Ecological System and the WTS

- The confederation's simulator simulates the decisions of all participants in the poached species' ecosystem. The abundance of this species is also modeled.
- All of these submodels interact with each other through time.

# The Simulator Identifies the Most Destructive Traffickers

- The simulator is first, statistically fitted to a political-ecological data set.
- Then, this fitted simulator is then used to predict the poaching rate assuming a certain set of traffickers are active in the simulation.
- These predictions are used to assign traffickers to the confederation's Ecosystem Effects sublist.

# A Fitted Simulator's Actions History




**mn** indicates *no group*.

# Technology #5: Ecosystem Monitoring

The monitoring program collects and streams to the biodiversity dashboard, real-time values on the number of tiger trafficker arrests, the number of tiger trafficker convictions, the number of intercepted shipments of tiger parts, and estimates of tiger abundance in the Bandhavgarh Tiger Reserve, India.

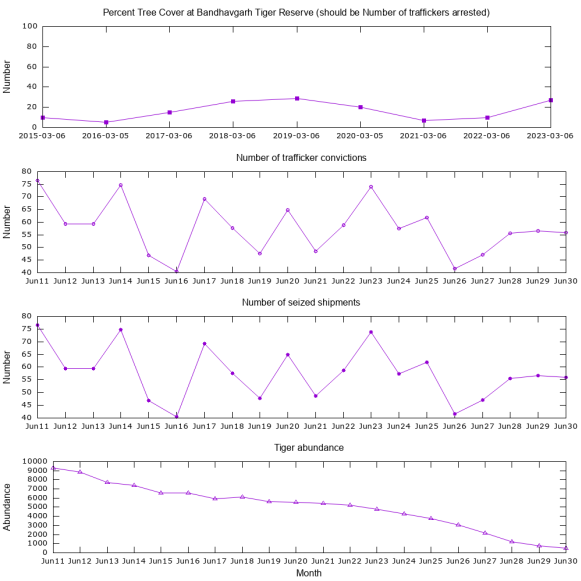
# The Liaison Consultant's Vital Role

- The firm's liaison consultant works with India's National Tiger Conservation Authority to secure this *capture-recapture data* for the confederation's peer-to-peer (P2P) wildlife crime database.
- A SAS code that uses a continuous-time approach to using such data to estimate tiger abundance is at `profitablebiodiversity.com/software`.

# Technology #6: A Biodiversity Dashboard

- The JavaFX™ code that downloads the needed data along with the script that creates the dashboard's graphics is at this same site.
- An audit information note is on this dashboard that states: "Audit information is available at https://insurance_firm.com/tigers/audit/."

# A Hypothetical Biodiversity Dashboard



# Limitations and Conclusions

- International wildlife trafficking is destroying biodiversity. An international confederation of wildlife crime investigators using a P2P criminal intelligence database would help to curb this destruction by bringing these traffickers to justice.
- A real-world case study of this Business Plan is needed to demonstrate its feasibility and effectiveness.

# Future Work

- Most governments and many NGOs have wildlife trafficking investigation units. Demonstrate this confederation organization and associated database to them.
- Build an experimental confederation and associated criminal intelligence database. Acquire user impressions of its effectiveness and trust levels.

# A Kit and Several Codes

- The Intel Kit at `profitablebiodiversity.com` contains a set of documents that a firm can use to build their own biodiversity offering and attached trafficking investigations biodiversity project.
- All marketing analytics, database, and modeling software is at `profitablebiodiversity.com/software`